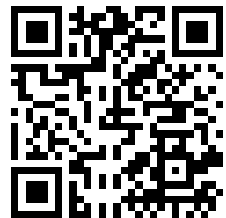

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ASSISTED BY

LIEUTENANT-COLONEL A. E. HAMERTON, C.M.G., D.S.O., R.A.M.C.

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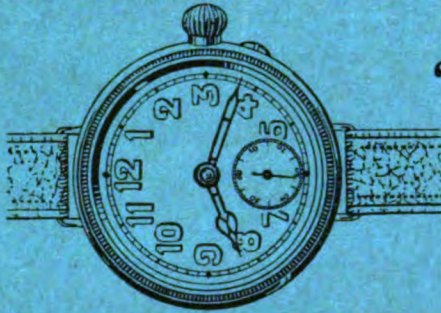
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Journal
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Original Communications.

A CASE OF DEPOSITION OF THE EGGS OF *HEPATICOLA*
HEPATICA IN THE HUMAN LIVER.

By MAJOR G. H. DIVE, D.S.O.

Royal Army Medical Corps,

AND

MILITARY ASSISTANT-SURGEON H. M. LAFRENAIS.

Indian Medical Department.

WITH A NOTE ON THE IDENTITY OF THE EGGS.

By BREVET LIEUTENANT-COLONEL W. P. MACARTHUR.

Royal Army Medical Corps.

IN September, 1923, an autopsy was performed on a British soldier aged 20, with a total service of four years, the last three of which were in India.

The clinical symptoms were chiefly those of a septic pneumonia and in view of the post-mortem findings death from pyæmia was returned.

Extracts from post-mortem findings:

"A large number of superficial abscesses widely scattered in both lungs immediately beneath the pleura—on section of the lungs the abscesses were seen to be typically wedge shaped."

"Liver-weight seventy-eight ounces. On section an abscess (size three inches by two inches) was found in the right lobe which discharged thick creamy pus: the abscess had a sponge-like appearance due to the fusion of numerous points of suppuration."

No pathological changes were noted in any other organ or tissue.

Sections of the lung and liver were cut for microscopical examination.

No evidence of infection with tubercle or *Entamæba histolytica* was found in these tissues, and there had been no history of such infection.

2 ~~Deposition of Eggs~~ of *Hepaticola Hepatica* in the Human Liver

~~In the liver~~ in proximity to the abscess were found masses of eggs which have been identified by Lieutenant-Colonel W. P. MacArthur as those of *Hepaticola hepatica*.

No corresponding condition was found in the sections of the lung. A staphylococcus was isolated from the pus of both liver and lung.

The pathological sequence in this case would appear to be nematode infection, deposition of eggs in the liver, suppuration *in situ*, secondary infection of the lungs, i.e., a condition of pyæmia resulting in death.

We are indebted to Major J. A. Cruickshank, I.M.S., of the Pasteur Institute, Coonoor, for the provision of facilities for the examination of tissues, and to Lieutenant-Colonel A. W. Gibson, R.A.M.C., the Officer Commanding, British Station Hospital, Wellington, Madras, for permission to publish the above notes.

NOTE BY BREVET LIEUTENANT-COLONEL W. P. MACARTHUR, R.A.M.C.

The liver sections forwarded by Major Dive show a heavy deposition of trichurine eggs which lie mainly in the interstitial tissue between the lobules, a few being actually intralobular. The masses of eggs have become encysted by the formation of a definite fibrous tissue wall. The liver tissue in contact with this is undergoing pressure atrophy and disintegration. There is no small round-celled infiltration, nor other sign of acute inflammation. Consequently the abscesses described by Major Dive must have resulted from some secondary infection to which the damaged condition of the liver would render it particularly susceptible.

Many of the eggs have collapsed, but favourable specimens showing recognizable characters can be found. The outer shell is radially striate and closely applied to the inner shell. There is a terminal opercular plug at either pole. The eggs have a familial resemblance to those of *Trichuris trichiura*, but differ in very obvious respects. In shape and structure they are indistinguishable from those of *Hepaticola hepatica* (Bancroft, 1893) Hall, 1916. Further, as regards size, ten of the more perfect eggs in the liver sections gave an average measurement of 55.2μ by 30.3μ , and ten eggs similarly selected in sections of rat liver infected with *Hepaticola hepatica* averaged 55.4μ by 29μ .

Consequently I have diagnosed the infection as due to this Nematode.

There are no worms in the sections examined, but these do not include the portions of the lesions most likely to contain worms, or their remnants, if these should still persist.¹

Hepaticola hepatica belongs to the family Trichinellidæ, which includes the whip-worm of man, *Trichuris trichiura*, and another occasional human parasite, *Trichinella spiralis*.

Hepaticola hepatica is normally a parasite of rats, and was first described by Bancroft (1893) under the name *Trichocephalus hepaticus*.

¹ See postscriptum.

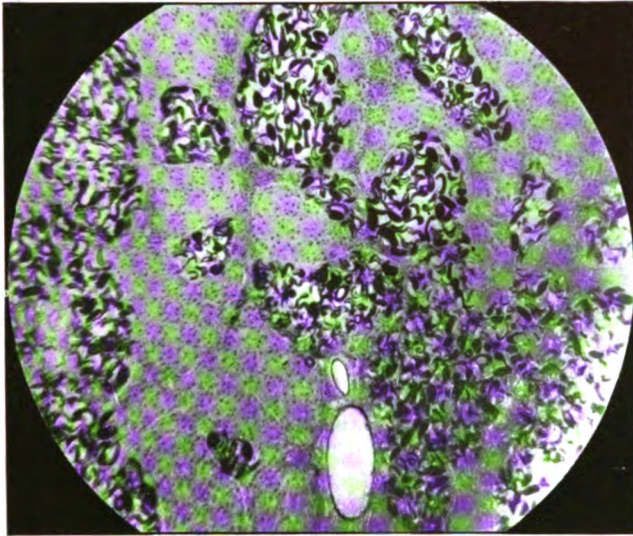


FIG. 1.—Section of human liver, showing eggs of *Hepaticola hepatica*. $\times 60$.

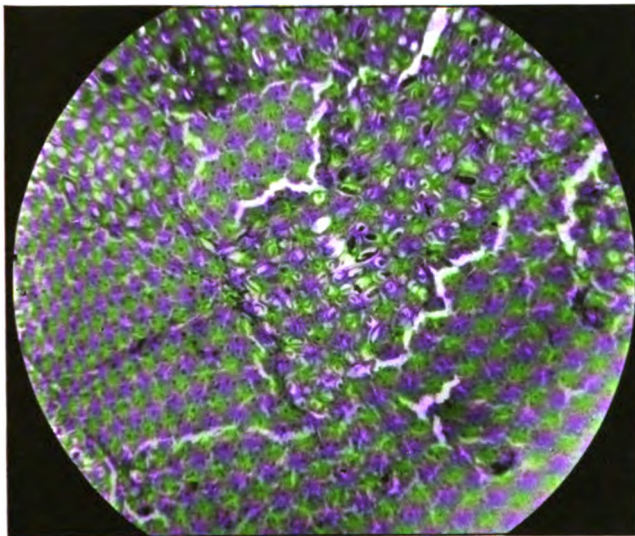


FIG. 2.—Section of rat liver, showing eggs of *H. hepatica*. $\times 60$.

To illustrate "A Case of Deposition of the Eggs of *Hepaticola hepatica* in the Human Liver," by Major G. H. DIVE, D.S.O., R.A.M.C., and Military Assistant-Surgeon H. M. LAFRENAIS, I.M.D., with a "Note on the Identity of the Eggs," by Brevet Lieutenant-Colonel W. P. MACARTHUR, R.A.M.C.



FIG. 3.—(Drawn with *camera lucida*.) A—Three eggs of *H. hepatica* in section of human liver ; B—Three eggs of *H. hepatica* in section of rat liver ; C—Complete *H. hepatica* egg in scraping of the liver from which the section shown in B was prepared. (For dimensions of eggs, see text.)

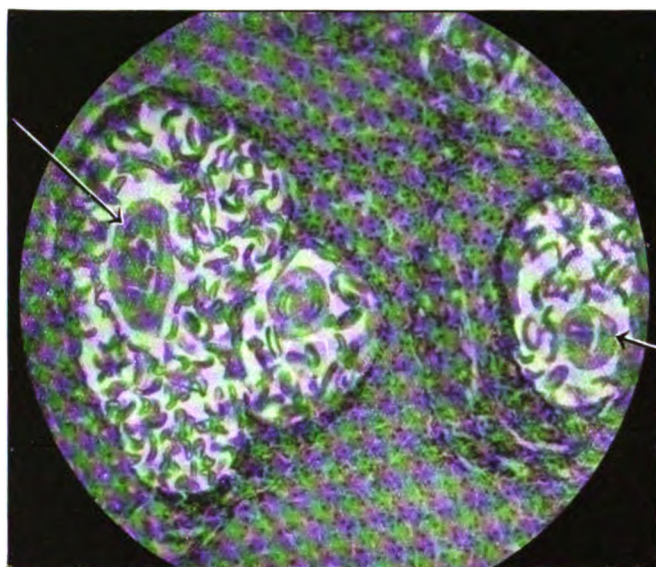


FIG. 4.—Transverse section of *H. hepatica* in human liver.
(See postscript.) $\times 100$.

To illustrate "A Case of Deposition of the Eggs of *Hepaticola hepatica* in the Human Liver," by Major G. H. DIVE, D.S.O., R.A.M.C., and Military Assistant-Surgeon H. M. LAFRENAIS, I.M.D., with a "Note on the Identity of the Eggs," by Brevet Lieutenant-Colonel W. P. MACARTHUR, R.A.M.C.

Hall (1916) created the genus *Hepaticola* for this species, but Railliet (1916) regarded Hall's genus as only doubtfully distinct from the genus *Eucoleus* Dujardin, 1845, several species of which parasitize the lungs of various animals. However, the generic validity of *Hepaticola* appears to be generally accepted at present.

Rats can be infected experimentally by the ingestion of ripe eggs, and this presumably constitutes the natural mode of infection.

The eggs hatch in the intestinal canal, especially in the cæcum, and the larvæ penetrate the wall of the gut. After an interval varying from a few days to a fortnight larvæ are found in the liver, the migration having taken place mainly by the blood-stream. Fülleborn (1924) observed that occasionally larvæ may be found in the lungs. After maturation the females deposit large numbers of eggs in the liver tissue, and finally the adult worms die and are absorbed. According to Bancroft (1893) this takes two to three weeks. Severe infections cause an intense reaction in the liver, and many animals perish as a result. In mild cases the liver recovers itself and presents a normal appearance except for the presence of eggs and some resultant cirrhosis.

The means by which the eggs leave the body of the host is uncertain. Bancroft failed to find any evidence of passage through the bile ducts, but Hall (1916) quotes Railliet as stating that he found eggs in the fæces of infected rats, an observation which requires to be confirmed. The eggs require some weeks' exposure to oxygen in order to mature, and the contained embryos may remain alive for at any rate two years and five months. Consequently it seems possible that infection may be transmitted by the ingestion of eggs liberated from the host's body in the natural process of disintegration after death.

In connexion with the curious development of this parasite it is interesting to note that the whip-worm of man, *Trichuris trichiura*, has been shown by Fülleborn (1923) to infect the intestine directly, there being no migration of the larvæ in the process of development.

As mentioned above, the rat is the normal host of *Hepaticola hepatica*, and infection has been recorded in several species of these rodents.

Nicoll (1911) described eggs somewhat resembling those of *Trichuris* or *Trichosoma* in the liver of a hare. The case has since been recorded as a possible infection with *H. hepatica*. In a close scrutiny of many hundreds of eggs of this species I could find none with a close resemblance to Nicoll's figures.

The present instance is the first recorded occurrence of *Hepaticola hepatica* in man.

Professor R. T. Leiper, F.R.S., very kindly provided the infected material used for the rat liver preparations illustrating this note. I am also much indebted to Lieutenant-Colonel H. E. R. James, R.A.M.C.(Ret.), for making the drawings reproduced in fig. 3.

Postscriptum.—In order to search further for the presence of worms,

4 *Deposition of Eggs of Hepaticola Hepatica in the Human Liver*

I asked for some material from the periphery of the liver lesion. Since writing the foregoing note this has arrived and has been found to contain pieces of several mature female worms. Unfortunately the tissue was prepared originally for sectioning for histological purposes which makes a satisfactory examination of the worms extremely difficult. The characters discernible up to the present, however, are confirmatory of the identification recorded above. (See fig. 4, which shows sections of the worms in the liver.)—W. P. MacA.

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SECONDARY WOUND SHOCK : ITS CAUSATION, PREVENTION AND TREATMENT.

BY CAPTAIN J. A. W. EBDEN, M.B., F.R.C.S.

Royal Army Medical Corps.

THE term "Shock" was first introduced in 1795 by James Latta, to designate the condition following upon severe injuries. Shock is described as being primary or secondary. Primary shock is the immediate result of the injury. It resembles syncope and is probably caused by a reflex inhibition of the cardio-inhibitory centre in the medulla. The pallor observed is thought to be due to vasoconstriction and the sweating to sympathetic stimulation.

Secondary shock is that condition which develops after sufficient time has elapsed for the primary shock to pass off, or it may develop independently of the latter condition. The time taken for secondary shock to develop varies with the nature of the injury and the treatment of the patient. It may be defined as a condition of depression of the vital functions of the body which results from injuries, and which is associated with a fall in blood-pressure.

PATHOLOGICAL PHENOMENA OBSERVED IN SECONDARY SHOCK.

Before dealing with the causation of shock, it is necessary to refer briefly to some of the more constant pathological findings. These are :—

(1) *Changes in the Blood.*—(a) Fall of blood-pressure : This is a most common occurrence in secondary shock. The time which elapses between the receipt of the injury and the fall of blood-pressure is variable. It is considered that shock may be present before the fall of blood-pressure is apparent. This fact would appear to account for the sudden collapse, sometimes observed in severely injured individuals, whose pulses were quite good a short time previously. The systolic pressure commonly falls below 100 millimetres Hg and the diastolic pressure below 70 millimetres. In cases of profound shock the systolic pressure may fall as low as twenty millimetres and the diastolic pressure may become imperceptible. When the systolic pressure falls below eighty millimetres the condition must be looked upon as serious. Cases which recovered were seen during the late war where the systolic pressure was as low as twenty millimetres (Fraser and Cowell) [2]. A steadily rising or sustained high pressure, even in the presence of grave injuries, may be looked upon as a most favourable prognostic sign.

(b) Reduction in the volume of the blood and plasma : In cases with distinct symptoms of shock, the blood volume is reduced to 51 to 85 per cent of normal, and the total plasma volume to 62 to 90 per cent of normal [3].

That this is not entirely due to a loss of blood from the body is shown by the fact that when as much as 800 cubic centimetres of blood is taken from a donor for transfusion, his blood volume becomes normal within an hour or so. Moreover this reduction in volume has been observed in cases of shock where there has been no hæmorrhage.

(c) Concentration of the blood: Lenhart [4] and others have shown that there is an increase in the hæmoglobin and red cell counts. Cannon [5] has shown that the red cell count is greater in the skin capillaries than in the veins and deep capillaries. It has also been observed that the capillary count is greater in the more distal portions of the extremities and that it appears to be increased by cold. For example, a capillary count from the warm mucous membrane of the mouth of an individual suffering from shock is less than that from the ear or the finger.

(d) Increase in the viscosity of the blood: The concentration of the blood tends to increase its viscosity, but cold also plays an important part. Denning and Watson [6] have shown that a fall in temperature of 1° C. increases the viscosity of the blood by three per cent.

(e) Acidosis: This is usually present and is due to an increase of the hydrogen ion concentration of the blood. Cannon and others [7] have shown that there is a fall in the reserve alkali of the blood. Lovell [18] has pointed out that there is an excess in the excretion of amino-acids. Acidosis is not now looked upon as being of much importance in the causation of shock, as it has been shown that the condition may be present without it.

(2) Changes in Nerve Cells: These are chiefly a loss of Nissl granules and changes in the colour reactions in the sensory cells of the brain. Crile [8] lays particular stress on the changes seen in the Purkinje cells of the cerebellum and describes a stage of hyperchromatosis, followed by chromatolysis, and, in a small number of cells, complete disintegration. Crile [8] claims to have shown experimentally that the cells recover after sleep.

(3) *Changes in the Cells of the Liver and Adrenals.*—These cells show swelling, vacuolation, loss of cytoplasm and disappearance of nuclei.

(4) *Loss of Body Heat.*—It is common for the buccal temperature to be below 95° F., and it has been recorded as low as 87° F. [17]. The skin and extremities are colder than this.

Other phenomena which may be observed are: a shrunk facies; an increased pulse-rate; sometimes an increased respiratory rate; cyanosis of the nails; and sweating. Sweating, strictly speaking, belongs to the stage of primary shock but may be continued into the stage of secondary shock.

PREDISPOSING FACTORS IN THE CAUSATION OF SHOCK.

Experience has shown that certain conditions appear to predispose to the development of secondary shock.

(1) *Nervous Temperament.*—Individuals of a highly strung tempera-

ment are more susceptible to the development of shock than those of a more phlegmatic disposition. When the former class of patients develops shock, it is apt to be of a more severe nature than in the case of the latter.

(2) *Mental anxiety and excitement*—such as is caused by exposure to shell-fire or fear of a surgical operation.

(3) *Cold and exposure.*

(4) *Shortage of food and water.*

(5) *Fatigue.*

(6) *Toxæmia.*

PRIMARY CONDITIONS WHICH APPEAR TO GIVE RISE TO SECONDARY SHOCK.

Secondary shock frequently follows upon severe injuries and extensive surgical operations.

At ordinary times good examples are seen after an abdominal injury, and after severe operations such as amputation at the hip-joint. During the late war the condition was seen after the following types of injuries: Single large wounds of muscle, especially when accompanied by a good deal of hæmorrhage; small multiple wounds; short-range wounds; penetrating wounds of the abdomen; very painful wounds, bad compound fractures of the femur, especially where proper splinting was not carried out early and where transport was over rough roads; and wounds of the central nervous system, especially where the spinal cord was involved. It was noticed that in extensive wounds of the limbs shock was more marked the nearer the wound was to the trunk. It was also observed that shock was more marked in wounds of the lower limbs than in wounds of the upper limbs.

Sometimes secondary shock occurs in cases where the injuries appear to be quite trivial. In this connexion Cuthbert Wallace [9] records two cases, which proved fatal. Both cases developed the typical signs of shock, one after being buried in a cellar by the explosion of a shell and the other after being blown up by a shell. Post-mortem examination in neither case showed any gross lesion.

SECONDARY OR AGGRAVATING FACTORS IN THE CAUSATION OF SHOCK.

In addition to the causes already mentioned, the experience of the late war and experimental research have shown that there are several other conditions which tend to assist in the production of shock and to aggravate it when it has already developed. A knowledge of these is essential as it plays an important part in the prevention and treatment of shock. These factors are:—

(1) *Cold and Exposure.*—It has been proved experimentally [6] that cold increases the viscosity of the blood and produces capillary stagnation

and this will be shown later to be one of the most important of the early phenomena of shock.

(2) *Hæmorrhage*.—This not only refers to a large hæmorrhage but also to slight and continuous hæmorrhage, which is more likely to be overlooked in times of stress. It is often very difficult to determine with certainty whether an individual is suffering from the effects of hæmorrhage alone or from shock in addition. It has been shown that animals which have been bled are more susceptible to the development of shock [10].

(3) *Pain*.—According to Crile [8] pain acts by causing different impulses which exhaust the nerve cells. As will be shown later it is doubtful if this is the real explanation, but the fact remains that experience has shown that pain does tend to produce and to aggravate shock.

(4) *Want of Sleep and Fatigue*.—It has been shown experimentally in animals that want of sleep produces cell changes similar to those seen in shock and that after sleep the cells recover (Crile) [8]. Crile [11], in his latest work on shock, states that it is produced by an alteration in the mechanism which produces the normal rhythmic alternation of consciousness and sleep.

(5) *Exertion*.—For example a severely wounded man who walks some distance after receiving his wound will considerably increase his chances of developing shock.

(6) *Drugs*.—Chloroform and ether anæsthesia, stimulants such as strychnine, and vasoconstrictors such as adrenalin, all tend to produce and aggravate shock when administered to severely injured individuals. The question of drugs and anæsthetics will be dealt with more fully in speaking of the prevention and treatment of shock.

(7) *Surgical Operations*.—These tend to produce shock in borderline cases. It is possible, however, that the anæsthetic may be largely to blame for the bad effects formerly attributed to operations.

(8) *Absorption of Toxins from Sepsis and from the Products of Disintegrated Tissue in Wounds*.—This factor will be dealt with later.

(9) *Emotional Stimuli*.—Such as those producing fear. By subjecting animals to stimuli producing fear, all the pathological cell changes found in shock have been produced (Crile) [8].

(10) *Loss of Fluid from the Body*.—In addition to hæmorrhage which has been already mentioned, this may be brought about by prolonged vomiting, or persistent diarrhoea such as is seen in acute cholera.

THEORIES AS TO THE CAUSATION OF SHOCK.

Many theories have been put forward from time to time to account for the phenomena observed in shock, but most of them fail in some respect and no one theory suffices to fully explain the condition. It is probable that the true explanation lies in a combination of these theories.

The more important of the theories of shock are :—

(1) *That the Condition is one of Adrenalin Deficiency* [12].—This theory

was put forward to account for the fall in blood-pressure observed in shock. There are various arguments against it. Rendle Short [13] has shown that in patients who die from shock the adrenals contain plenty of adrenalin. Stewart [14] and others have shown that there is no change in the adrenalin output in the suprarenal veins of animals suffering from shock, and Mann [15] has pointed out that total excision of the adrenals in animals does not produce the phenomena of shock.

(2) *That the Condition is due to a loss of Carbon Dioxide.*—This is known as the Acapnia Theory of Henderson [16] who held that pain produced rapid breathing, which resulted in an excessive elimination of carbon dioxide from the blood. This caused the respiratory centre to act feebly, as it was no longer sufficiently stimulated by carbon dioxide and so the supply of oxygen to the tissues became deficient and shock resulted.

Against this theory is the fact that some patients suffering from shock have no pain and their breathing is shallow and there can therefore be no excessive elimination of carbon dioxide [17]. Furthermore fatal cases of shock have been recorded where the blood content of carbon dioxide was normal [18]. It has also been noticed that the inhalation of carbon dioxide does not relieve the condition.

(3) *That Shock is due to the Exhaustion of Nerve Cells.*—Some have argued that shock is due to exhaustion of the vasomotor centre [8], which produces dilatation of the arterioles and a consequent fall of blood-pressure. The evidence against this is supplied by Porter [19], who has shown that in animals suffering from shock, pressor and depressor reflexes still occur, which proves that there is no exhaustion or impairment of the vasomotor mechanism. In the final stages of shock, just before death takes place, paralysis of both the respiratory and vasomotor centres undoubtedly occurs, but this is only a terminal phenomenon.

Crile [8] and others hold that the condition is due to exhaustion of nerve cells in the brain, which is caused by afferent impulses. This argument appears to be based on the post-mortem findings in shocked animals and assumes that the changes seen in the nerve cells indicate exhaustion, and are the cause of shock. That these cell changes are not necessarily due to afferent impulses has been shown by Miller [20], who by the use of a string galvanometer has demonstrated that anæsthetics block the passage of afferent impulses to the brain, and it is well known that shock can be produced under anæsthesia. Dolley has shown that hæmorrhage produces similar cell changes. Although these changes in nerve cells are seen in shock, there are no grounds for believing that they are the cause of the condition and they can only be looked upon as the result of it.

(4) *That the Condition is due to Cardiac Failure.*—The supporters of this theory believed that the primary condition was one of cardiac failure, which resulted in a fall of blood-pressure, leading to the production of the other phenomena of shock. Boise noticed that animals dying from shock

showed contraction of the ventricles, and from this concluded that shock was produced by an arrest of the heart's action in systole. That the heart muscle is not at fault in shock is shown by the fact that when blood is transfused or adrenalin injected and the blood-pressure thereby raised, the heart promptly responds by contracting more slowly and vigorously. When the blood-pressure has been maintained at a low level for some time, the efficiency of the heart may become impaired, although no primary defect is present.

It has also been suggested that the condition is brought about by paralysis of the cardio-inhibitory centre, but Mann [21] has shown that in animals suffering from shock this centre responds to reflex stimulation.

(5) *That the Condition is due to Fat Embolism.*—Some observers [22] have held that shock was due to fat embolism from the fact that they were able to produce the condition in animals by the injection of fat globules into a vein and that they observed fat globules in the blood of animals suffering from shock. There is, however, no reason to suppose that fat embolism occurs after an abdominal injury, although it has been known to occur after fractures. Furthermore McKibben [18] has shown that fat globules are normally visible in the blood of animals, and Rendle Short [18] has reported having found them in his own blood.

(6) *That the Condition is due to Engorgement of the Abdominal Veins, especially in the Splanchnic Area.*—This theory was put forward to account for the loss in volume of the circulating blood and the resulting fall of blood-pressure. It was found that when the abdomen of an animal was opened and the intestines were freely handled, shock was produced and the mesenteric veins became engorged [23]. The fact that this condition does not occur in ordinary wound shock was demonstrated conclusively during the late war. When the abdomen of individuals suffering from shock was opened, no venous engorgement was ever observed [24].

(7) *That the Condition is due to Acidosis.*—Acidosis due to an increase in the hydrogen ion concentration in the blood is found in shock, but it can hardly be accepted as the cause. It has been shown that shock may be present without acidosis (Keith) and conversely that a considerable degree of acidosis may exist without shock (Bayliss and Dale) [47].

Acidosis is now looked upon as being protective rather than harmful, except in the terminal stages of shock. The increase of the hydrogen ions in the blood, by action on the respiratory centre, tends to produce deeper and more efficient respiration and thereby to increase the oxygen intake. It also attempts to restore the falling blood-pressure by producing slight arterial constriction through stimulation of the vasomotor centre. This protective influence is, however, very slight. In the terminal stages this action probably further retards the flow of blood through the capillaries and accelerates the final collapse [25].

The causation of acidosis will be dealt with later.

(8) *That the Condition is due to the absorption of the Toxic Products of*

Crushed Muscle.—It has been observed that a condition similar to shock could be produced in animals by injecting extracts of crushed muscle. Turck, Bayliss and Cannon [26] have shown that ligature of the limb of an animal, followed by crushing of the muscles, then release of the ligature and massage of the limb so as to drive the "crush products" into the circulation, produces a fall of blood-pressure. That this fall of blood-pressure is not due to reflex causes was shown by the fact that it could be produced when the cord had been divided. It was also noticed that a permanent fall of blood-pressure could be prevented by ligature of the vessels above the injured part so as to prevent the blood flowing in and out of the damaged area.

Further work has been done by Dale and Laidlaw [27], who have produced the symptoms of shock by the injection of histamine. Histamine is a substance formed by the removal of the carboxyl group from histidine, which is an amino-acid. Amino-acids are the most important class of protein decomposition products. Histamine has not actually been found in muscle, but disintegrated muscle is supposed to contain substances with a similar physiological action. When histamine is injected into an animal it causes generalized dilatation of the capillaries and contraction of the arteries. There is a great fall of blood-pressure and marked concentration of the blood, giving rise in some cases to a loss of half the original volume of the plasma in so short a time as five minutes. This is apparently brought about by its causing an increased permeability of the walls of the capillaries, in addition to dilatation, so that not only does water escape into the tissues, but also all the plasma constituents. This latter fact is proved by the observation that the protein content of the plasma does not rise in proportion to the reduction in volume. Dale and Laidlaw consider that this poison destroys the tone of the capillaries so that they dilate and the blood in them becomes stagnant, with the result that the amount which reaches the veins is insufficient for filling the heart. In consequence of this the cardiac output becomes lessened and the blood-pressure falls. They have also pointed out that previous bleeding of an animal increases the toxic action of histamine. This fact is in agreement with the clinical observations that in extensive wounds of muscle shock is more pronounced in those cases where there has been hæmorrhage.

Inchley [28], who is at present working on this subject, has just published a preliminary communication in which he claims to have shown experimentally that histamine causes a constriction of the venules, which leads to capillary engorgement and consequent œdema. This observation would appear to have an important bearing on treatment. From it Inchley concludes that a preliminary dilatation of the veins by nitrites, followed by the infusion of a sufficient quantity of Ringer's solution to fill the dilated veins, would prevent death after a toxic dose of histamine. He has experimentally shown this to be so in the case of a cat and is at present moment engaged on these lines in attempting to discover a method of

treatment after the induction of histamine shock. Dale [29] in a recent communication admits that histamine produces a constriction of the venules, but does not consider that this plays an important part in the production of the other phenomena observed. Crile [8] is strongly opposed to this theory and as evidence against it quotes the result of the following experiment. He crossed the circulation in two dogs by anastomosing the proximal end of the carotid artery in one to the distal end of the carotid artery in the other and then by anastomosing the corresponding jugular veins. In this way he caused their blood-streams to intermingle freely. For two hours he traumatized one dog and then killed both simultaneously. He examined the brains of both dogs in a precisely similar manner and found that cell changes were present only in the brain of the traumatized dog. No changes were seen in the brain cells of the other dog, although the blood of the traumatized dog had circulated freely through its brain for two hours. The conclusions arrived at by Crile, from the result of this experiment, are based on the assumption, already referred to, that the changes in the nerve cells indicate exhaustion and are the cause of shock. The absorption of toxic products of disintegrated muscle appears to be one of the important factors in the production and aggravation of shock.

(9) *That the Condition is due to the Stagnation of the Blood in the Peripheral Capillaries.*—Bayliss considers that the real explanation lies in the similarity between shock and the result of a severe hæmorrhage. In the former there is a loss of blood by stagnation in the capillaries and in the latter there is an actual loss. In both cases there is a fall of blood-pressure with the result that there is an inadequate supply of blood and consequently of oxygen to the tissues. The result of this is that the tissue cells cease to function and their metabolism alters to one that may be harmful. A moderate fall of blood-pressure causes a great reduction in the volume of the circulating blood. This has been demonstrated experimentally by Gesell [18], who showed that in a cat, a fall of systolic pressure from 124 millimetres Hg to 84 millimetres Hg caused the blood flow in the submaxillary gland to be reduced to one-sixth of what it originally was.

It is easy to imagine how the cells, suffering from oxygen starvation, demand local capillary dilatation, and how this in turn draws more blood into the stagnant area and brings about a further fall in blood-pressure. The question now arises as to how this capillary stasis is brought about. The part played by the absorption of the products of disintegrated tissues has already been discussed. Probably the most important factor of all is, chilling of the surface of the body, which is caused by exposure and to some degree by sweating. With regard to sweating, Cowell [30] has shown that it is a prompt and characteristic reaction to a severe injury. Sweating causes a loss of body heat by evaporation, and is the explanation of how heat is lost when the surrounding temperature is the same or greater than that of the body.

The explanation of the occurrence of acidosis and the fall of the reserve alkali of the blood is that it is due to an imperfect oxidation of the products of tissue metabolism, brought about in the manner just described, which results in the production of acids which combine with the reserve alkali of the blood. Although it does occur, acidosis can no longer be looked upon as an important factor in shock, as it has already been pointed out that shock may exist without acidosis and vice versa.

The various cell changes observed in shock are due to deficient oxygenation and perhaps to some degree to the direct action of toxic substances derived from damaged tissues [31].

The question of the part played by anæsthetics in the production of shock will be dealt with in the next section.

To recapitulate, shock may be looked upon as the result of several factors, such as cold, toxins, hæmorrhage and anæsthetics. The effect produced depends upon the intensity of each, on how many of them are acting at one time, and on the length of the period for which they have acted.

(To be continued.)

REPORT ON EXPERIMENTAL WORK CARRIED OUT AT THE
ARMY SCHOOL OF HYGIENE TO DEMONSTRATE THAT
CHLORINE GAS IN ASSOCIATION WITH AMMONIA GAS
IS A MORE EFFICIENT STERILIZER OF WATER
THAN CHLORINE GAS USED ALONE OR CHLOROS OR
BLEACHING POWDER.¹

BY MAJOR C. H. H. HAROLD.

Royal Army Medical Corps.

AND

CAPTAIN A. R. WARD.

Royal Army Medical Corps (T.A.).

(Continued from p. 423, June, 1924.)

EXPERIMENT No. 11.—A Comparison between the killing power of
bleaching powder solution, bleaching powder solution and ammonia,
chlorine water and ammonia.

	Deviation : Chlorine added = 2 parts per million.		As B.p. solution = deviation.		As chlorine = deviation	
	A	B	A	B	A	B
0.1 c.c. broth culture to 200 c.c. autoclaved tap water	0.7	0.4	0.7	0.7		

These figures should be compared with standard solutions of bleaching
powder and chlorine water, titrated with acid as is customary. (*Vide* below.)

	Amount of chlorine given by titration		
	Without acid	..	With acid
200 c.c. freshly-distilled water plus 2 c.c. standard chlorine water solution (= 2 parts per million of Cl)	1.9	..	2.0
Do. plus 2 c.c. standard bleaching powder solution (= 2 parts per million of Cl)	1.35	..	2.0

In making up a standard solution of chlorine or hypochlorites the
strength of the chlorine solution is determined either by Penot's method or
by the thio-sulphate method in which acid is added and the titration results
of these two methods agree. If the acid is not used in the thio-sulphate
titrations, a smaller and entirely different chlorine content is found.

Similarly, in these extremely dilute solutions containing only two parts
per million of Cl if no acid is added, the true chlorine content is not found
and a greater deviation is recorded.

¹ Read before the Navy, Army and Air Force Group of the Society of Medical Officers
of Health, February 1, 1924.

Deviation and Killing Power.

Amount of chlorine added, in parts per million	1		2		3		4	
	A	B	A	B	A	B	A	B
0.1 c.c. of B.a. broth culture to 200 c.c. autoclaved tap water and B.p. solution					1.0	0.8	1.4	1.5
On plating out					+++	—	—	—
As above, plus twice quantity of NH_3 (NH_3 15 mins. and Cl for additional 45 mins. contact)			0.5	0.4	0.8	0.5	1.3	0.6
On plating out			+++	+++	+++	++	—	—
As above, plus equal quantity of NH_3 ..			0.3	0.3	0.75	0.4	0.9	0.5
On plating out			+++	++	—	—	—	—
As above, using chlorine water and twice quantity of NH_3 (chlorine added 15 mins. before NH_3)	0.45	0.30	0.7	0.5	1.3	0.8	1.9	1.3
On plating out	++++	+++	—	—	—	—	—	—
As above, using chlorine water plus equal quantity of NH_3 (chlorine added 15 mins. before NH_3)	0.35	0.30	0.55	0.55	0.8	0.6	1.8	1.3
On plating out	++++	++	—	—	—	—	—	—
As above, using chlorine water alone ..					0.8	0.7	1.3	1.0
On plating out					1 col.	—	2.0	1.5

In each case the chlorine contact was forty-five minutes before plating out.

It will be seen that chlorine gas gives better results than the same quantity of chlorine as bleaching powder solution; further that with bleaching powder the addition of an equal amount of ammonia tends to improve slightly the killing power; but with twice the quantity of ammonia the result is worse than with bleaching powder alone. With chlorine gas the addition of an equal quantity of ammonia causes a definite increase in the killing power and the addition of further ammonia tends to nullify this.

The difference in deviation as shown by "A" and "B" is of interest, and again a possible relationship between this figure and the lethal effect is indicated. (*Vide* Experiment No. 7.)

EXPERIMENT No. 12.—Similar to previous experiment, omitting bleaching powder solution.

Amount of Chlorine added, in parts per million	1		2		3		Remarks
	A	B	A	B	A	B	
(a) 0.1 c.c. broth culture of B.a. to 200 c.c. autoclaved tap water, plus Cl water alone			0.4	0.4	0.9	0.6	
On plating out			+++	+	—	—	
(b) Do. plus Cl water plus $\frac{1}{2}$ quantity NH_3	0.3	0.25	0.55	0.50	0.9	0.6	Cl water added 15 min. before NH_3
On plating out	+++	+++	++	—	—	—	
(c) Do. plus Cl water plus equal quantity NH_3	0.35	0.30	0.6	0.55	1.0	0.70	Do.
On plating out	+++	++	1 col.	3 cols.	—	—	
(d) Do. do. plus $\frac{1}{2}$ quantity NH_3	0.30	0.25	0.6	0.4	0.8	0.5	NH_3 added 15 min. before Cl water
On plating out	+++	+++	1 col.	—	—	—	
(e) Do. do. plus equal quantity NH_3	0.3	0.25	0.45	0.30	0.8	0.4	Do.
On plating out	+++	+++	+	8 cols.	—	—	
(f) Do. do. do.	0.3	0.3	0.4	0.25	1.0	0.5	In this case Cl water and NH_3 solutions were mixed together and added as one solution.

On plating out .. +++ +++ +++ ++

Strength of standard solutions used = 0.0002 Cl and 0.0002 NH_3 per cubic centimetre.

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In this experiment it is found that some improvement is effected by adding ammonia first, equal to half the quantity of Cl and (f) proves that, even in such dilutions, it is useless to mix the ammonia and chlorine solutions in order to add the two together, although by so doing the available chlorine content is unimpaired.

EXPERIMENT No. 13.—Similar to the two previous experiments, with alteration in the amount of ammonia added.

Amount of chlorine added in parts per million	1		2		3		Remarks
	A	B	A	B	A	B	
(a) 0.1 c.c. broth culture of B.a. added to 200 c.c. autoclaved tap water, plus Cl water alone	0.4	0.45	1.0	0.9	1.6	1.5	
On plating out.. ..	+++		2 cols.		—		
(b) Do. plus Cl water plus $\frac{1}{2}$ quantity NH_3	0.5	0.4	1.0	0.7	1.5	0.8	Ammonia added 15 min. before Cl
On plating out.. ..	+		—		—		
(c) Do. plus $\frac{1}{2}$ quantity NH_3	0.4	0.4	1.0	0.6	1.5	0.8	Do.
On plating out.. ..	++		1 col.		—		
(d) Do. plus $\frac{1}{2}$ quantity NH_3	0.4	0.4	1.3	0.9	1.8	1.3	Cl water added 15 min. before NH_3
On plating out.. ..	+++		5 cols.		—		
(e) Do. plus $\frac{1}{2}$ quantity NH_3	0.6	0.5	1.3	1.0	2.0	1.4	Do.
On plating out.. ..	+++		—		1 col.		
(f) Do. plus equal quantity NH_3	0.7	0.5	1.4	1.0	2.3	1.4	Do.
On plating out.. ..	+++		7 cols.		1 col.		
Deviation of autoclaved water alone			1.45	1.45			

In all cases the chlorine was given forty-five minutes' contact before plating out.

From this table it is obvious that hitherto we have been adding too much ammonia; (b) is undoubtedly very promising, as it shows a very definite improvement on (a); furthermore, (b) is better than (d), showing that the ammonia must be added first.

EXPERIMENT No. 14.—Similar to the three previous experiments, with altered amounts of ammonia.

Amount of chlorine added in parts per million	1		2		3		Remarks
	A	B	A	B	A	B	
(a) 0.1 c.c. broth culture of B.a. added to 200 c.c. autoclaved tap water plus Cl water alone	0.6	0.55	1.1	0.75	1.8	1.2	
On plating out	++++		—		—		
(b) Do. plus Cl water plus 1/10th part per million of NH_3	0.6	0.5	1.2	0.75	1.6	1.1	NH_3 added 15 minutes before Cl water
On plating out	++		—		—		
(c) Do. plus $\frac{1}{2}$ do.	0.5	0.5	1.1	0.7	1.7	1.0	do.
On plating out	—		—		—		
(d) Do. plus $\frac{1}{2}$ do.	0.5	0.45	1.2	0.75	1.6	1.0	do.
On plating out	—		—		—		
Deviation of autoclaved water alone			1.3	1.25			

It is interesting again to notice that the deviation of the autoclaved water alone is greater than when the broth culture is added. (Cf. previous results.)

In this experiment we at last find the quantity of ammonia calculated to give the best results to be a constant of one-quarter to one-half part per million.

EXPERIMENT NO. 15.—Comparison between the killing power of bleaching powder solution, chlorine water and chloros, with and without the addition of one-third part per million of ammonia.

Amount of chlorine added, in parts per million	1		2		3		Remarks
	A	B	A	B	A	B	
(a) 0.1 c.c. of broth culture of B.a. to 200 c.c. autoclaved tap water plus Cl water alone	0.80	0.75	1.3	0.80	1.8	1.4	
On plating out	+++		+		—		
(b) Do. plus Cl water plus one-third part per million NH ₃	0.60	0.63	1.1	0.70	1.60	1.00	(Ammonia allowed 15 minutes initial contact)
On plating out	+++		—		—		
(c) Do. do. (as B.p.) alone	0.50	0.45	1.0	0.60	1.5		
On plating out	++++		+++		+		
(d) Do. do. plus one-third part per million NH ₃							
On plating out	++++		+++		+++		
(e) Do. plus Cl as chloros	0.7	0.6	1.3	0.8	1.8	1.2	
On plating out	+++		+++		—		
(f) Do. do. plus one-third part per million NH ₃	0.7	0.5	1.3	0.8	1.7	1.2	
On plating out	++++		+		—		

The experiment proves Cl gas to be superior to either bleach or chloros. The addition of ammonia to the extent of one-third part per million increases the killing power of chlorine gas, and to a less extent also that of chloros; but with bleaching powder the addition of ammonia actually decreases the lethal action. Chloros is shown to be rather better than "bleach."

EXPERIMENT NO. 16.—To try the effect of ammonia and chlorine water on various types of pollution to which a suspension of B.a. agar culture in water (standard opacity 1,000 million per cubic centimetre) has been added.

Amount of chlorine added in parts per million	1		2		3		4		6	
	A	B	A	B	A	B	A	B	A	B
(a) 0.1 c.c. watery suspension of B.a. added to 200 c.c. of stagnant vegetable-polluted water after filtration through coarse filter paper. Plus one-third part per million of NH ₃			++++		++++				++++	++++

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Amount of chlorine added in parts per million.	1		2		3		4		5	
	A	B	A	B	A	B	A	B	A	B
Deviation of chlorine.										
(b) 0.1 c.c. watery suspension of B.a. added to 200 c.c. fecally-polluted water (1/5,000) after filtration through coarse filter paper. Plus one-third part per million of NH_3 .			0.9	0.7	1.5	1.3	2.3	1.8	2.9	2.5
			+		—		—		—	
(c) Do. (1/10,000). Plus one-third part per million of NH_3 .			0.8	0.55	1.3	1.1	1.8	1.4	2.5	1.9
			—		—		—		—	
(d) 0.1 c.c. watery suspension of B.a. in 200 c.c. autoclaved tap water. Plus one-third part per million of NH_3 .	0.35	0.2	0.7	0.5	1.4	0.9				
	+		—		—					

(a) Showed heavy nitrites, the chlorine going to oxidize these, leaving the organisms to flourish; (b) (c) and (d) give extraordinarily good results compared with Experiment No. 8.

The natural deviation of the water has not been allowed for, and the phenomenon of inhibition has not arisen.

EXPERIMENT NO. 17.—Taste of ammonia in drinking water.

- 1 part per 100,000 is not sensitive to litmus paper.
- 5 parts per 100,000 is sensitive to litmus paper in 1 minute.
- 10 parts per 100,000 gives slight change of taste.
- 20 parts per 100,000 gives definite taste.
- 30 parts per 100,000 gives strong taste.

Seeing that the amount of ammonia indicated by preceding experiments is only one-third part per million, this rules out any possible objection on that score.

EXPERIMENT NO. 18.—The PH value of water treated with ammonia and chlorine.

The effect of the addition of chlorine water and bleaching powder solution on the PH value of drinking waters has been dealt with rather fully in a previous article (Lothian and Ward: "Chlorination of Water in Galvanized Tanks"). Chlorine water increases the acidity slightly, and the effect of bleaching powder is peculiar, tending to give high initial increase of alkalinity which is quickly neutralized in the presence of CO_2 . Phenol red being sensitive only to the bicarbonate stage.

200 c.c. tap water plus one-tenth c.c. broth (Broth PH 7.4)	..	..	PH
" " " " plus one-third part p.m. NH_3.	..	..	6.8
" " " " " " plus Cl water 1 pt. p.m.	..	..	6.9
			6.6

These figures show a difference, but not sufficient to indicate that the killing power is due to this slight variation in PH value.

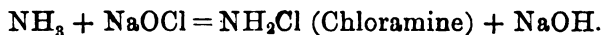
We are of the opinion, however, that the addition of chlorine gas to water containing free ammonia is conducive to the production of an acid reaction and the formation of chloramines or possibly other chlorine-ammonia group compounds. As is well known, chloramine is about

three times as effective a sterilizing agent as chlorine alone. Our experiments prove that in the presence of ammonia alkaline hypochlorites do not show the same increased sterilizing effect. It has been shown that chlorine water is much more effective than the same quantity of chlorine as hypochlorite; this is probably accounted for by the fact that in all the waters under examination ammonia was occurring naturally, and possibly the above-named compounds were produced without the addition of further ammonia.

In this connexion it is interesting to recall experiences with a variety of waters overseas. Ordinary chemical analyses carried out in France over a long period were supplemented by the amount of chlorine required to give one part per million of free chlorine in excess. The oxygen absorption figure, ammonia figures, and chlorine required were arranged in the form of a graph. These graphs showed no relationship whatever between the pollution and the chlorine required. In fact, it was often found that where there was a jump in the oxygen absorbed and ammonia figures—showing a more highly polluted water—there was a corresponding drop in the amount of chlorine required.

Few, if any, analyses show the ammonia present as free ammonia separate from the saline ammonia, it being too laborious a procedure for ordinary use; but it might be taken for granted that, with a neutral or slightly alkaline water, free ammonia is present where free and saline ammonia is recorded.

The effect of adding ammonia to a hypochlorite solution under certain conditions may be represented as follows:—



By the further addition of NH_3 we get $\text{NH}_2\text{Cl} + \text{NH}_3 = \text{N}_2\text{H}_4\text{HCl}$ (hydrazine hydrochloride).

By a still further addition of NH_3 , $\text{NH}_2\text{Cl} + 2\text{NH}_3 = \text{N}_2 + 3\text{NH}_4\text{Cl}$ (ammonium chloride).

Both chloramine and hydrazine are strong germicides, but ammonium chloride has no such property.

If, therefore, too much ammonia is added, as in the case of the earlier experiments, the desired effect is nullified. Chloramine has a definite objectionable taste and smell, whereas hydrazine is odourless.

According to Rideal, chloramine, like chlorine, has an oxidizing effect, whereas hydrazine has a reducing value, and he offers this as an explanation of the fact that continued germicidal action may take place when no free chlorine can be detected.

S. and E. Rideal, in their book on "Chemical Disinfection and Sterilization," state: "Experiments carried out on the River Somme during the war showed that by the interaction of chlorine with organic matter of animal origin, although a high 'Cl consumed figure' may be obtained, yet sterilization is easily effected; whilst the same dosage of

Cl for a water having an identical 'Cl consumed figure' is far less efficacious in sterilization when the organic matter is of vegetable origin."

This is very interesting and is a strong argument in favour of the routine addition of ammonia to effect sterility, seeing that a water containing organic matter of animal origin contains high free and saline ammonia, whereas water containing organic matters of vegetable origin gives low free and saline ammonia and high albuminoid figures.

The following is a table of analyses of some of the polluted waters used in these experiments.

Description	Results expressed in parts per 100,000			Remarks
	Oxygen absorbed in 4 hours at 50° F.	Free and saline ammonia	Ammonia albuminoid	
A. Water containing organic matter of vegetable origin, plus 0.1 c.c. of a B.a. agar culture suspended in water (opacity 1,000 millions per c.c.)	1.02	0.048	0.78	Nitrites present
B. Autoclaved tap water plus 0.1 c.c. broth per 200 c.c.	0.18	0.1	0.155	
C. Autoclaved tap water plus 0.1 c.c. B.a. broth culture per 200 c.c.	0.18	0.028	0.176	
D. Emulsified faeces (1 in 5,000) in tap water roughly filtered, plus 0.1 c.c. watery suspension of B.a. per 200 c.c.	0.44	0.494	0.49	
E. Emulsified faeces (1 in 10,000) in tap water roughly filtered, plus 0.1 c.c. watery suspension of B.a. per 200 c.c.	0.31	0.021	0.082	
F. Tap water	0.13	0.005	0.022	

It was anticipated that the analyses of these different types of polluted water would yield certain results indicating that inhibition is due to a factor or a combination of factors common to all.

F. Bourley water, our water supply, was the water used throughout these experiments. It is an upland water supply with a high iron content. It gives high albuminoid ammonia and oxygen absorbed figures.

C. This is the above water to which broth culture has been added (1 in 2,000). It shows a small rise in the oxygen absorbed figure, a bigger one in the free and saline ammonia, and a striking increase in the albuminoid figure.

D. Faecal emulsion, 1 in 5,000, shows a great increase in all figures, particularly in the albuminoid ammonia and free ammonia figures.

E. As above, 1 in 10,000. Main rise in the albuminoid ammonia and free and saline ammonia figures.

B. Plain broth in tap water; an outstanding increase occurs in the albuminoid ammonia figure.

A. The large amount of nitrites present in the water has entirely vitiated the results and it need not be further considered.

A high albuminoid ammonia figure would appear to be correlated with inhibition.

EXPERIMENT No. 19.—Taste.

The four individuals acting as a "Tasting Board" knowing that some of the sample waters were treated ones, were extremely critical. The following were given serial numbers, and the opinions written on slips of paper :—

Plain water, water containing chlorine gas, water containing chlorine and ammonia (one-third part per million), bleaching powder solution and chloros.

Series 1.—All treated samples of waters one part per million of available chlorine, irrespective of the deviation of the water, and thirty minutes were allowed for contact. (i) The consensus of opinion was that untreated was the best, although one member stated that (ii) was superior and that (i) contained chlorine. (ii) Chlorine gas plus NH_3 came an easy second, one member having placed this first and stated that it was the untreated water. Two members stated they could taste no difference between (i) and (ii), a third member, said to possess a very delicate palate, could just taste chlorine. On further tasting, two members decided that perhaps there was a difference between (i) and (ii). (iii) Bleaching powder gave a definite taste. (iv) Cl_2 gave a chlorinous taste. (v) Chloros gave a strong taste.

Series 2.—Containing two parts per million of chlorine. (i) Bleaching powder with a decidedly chlorinous taste. (ii) Chlorine and ammonia, with a more pronounced taste. (iii) Chlorine gas, with a bad taste (chlorinous). (iv) Chloros, the worst.

Series No. 2 is ruled out on account of taste, unless a method of dechlorination is employed.

Series No. 1. It is encouraging to note that from the point of view of palatability, chlorine gas plus ammonia is placed first of the treated samples, especially in view of the fact that in Experiment No. 16 it is seen that this combination is capable of sterilizing water with a 1 in 10,000 pollution.

CONCLUSIONS.

We are of the opinion that the anomalous results met with in practice are attributable to inhibition, and that the sterilization by chlorine and hypochlorites of waters with a high colloid content, such as may be met with overseas, is unreliable if only an examination for the presence of free chlorine in excess of natural deviation is relied on. Inhibition is induced by broth, excess of organisms, animal and vegetable pollution, and when it occurs an extremely large excess of chlorine is required to effect sterility ; and in fact a much larger quantity in some instances than is usually employed. For this reason excessive chlorination, with amounts of chlorine up to twelve parts per million, followed by partial or complete dechlorination, as was customary in many parts of France, commends itself to us as a very wise procedure ; and this method, which has been already

adversely criticized in certain quarters, is undoubtedly based on sound practical experience, and is now supported by scientific experiment.

In military practice, albuminoid matter is removed or reduced initially by sedimentation or clarification, but recently it has been shown that the clarifying powder used on the regulation water cart does not react with all waters, particularly with soft waters containing algal growths, and on these occasions the addition of sodium acetate is necessary to ensure coagulation.

The foregoing experiments indicate that in the control of chemical sterilization chemical analyses are of the greatest value. A high albuminoid figure, especially in conjunction with a relatively low chlorine absorption figure, should attract attention, and the possibility of inhibition must then be considered. When using chlorine gas, sterility should be fairly easily obtained in waters giving a high free and saline ammonia figure, indicating a not too recent nor too distant pollution. Waters containing nitrites in any quantity require a large excess of chlorine, and are unsatisfactory to treat.

The resistance to killing of the different species of excremental organisms in water heavily charged with colloid matter shows considerable variation, and they may apparently be graded in order of susceptibility. As our test organism, we have designedly employed an organism of this group possessing the greatest power of resistance. It must be admitted that when faecally polluted water was used in conjunction with laboratory cultures, the recently passed faecal organisms usually succumbed, whereas, as was expected, our laboratory culture organism (even of agar) proved more resistant. Even assuming that the majority of infective pathogens in moderately pure water can be easily killed by a low concentration of chlorine, the behaviour of the "resistant minority" in waters heavily loaded with colloid matter cannot be foreseen; and as in military operations the immediate consumption of treated water is the rule, it would appear eminently desirable to adopt a process whereby the most resistant species and types of excremental organisms are readily destroyed.

Strong corroboration of these findings appears in a recent paper by Mansell on the Chlorination of Milk, in which he points out that if cultures of cholera vibrios, *B. typhosus* and *B. dysenteriae* (Flexner) are added to milk, enormous quantities of chlorine are required to produce sterility; and even with such amounts *B. dysenteriae* (Flexner) is not destroyed. In this connexion, Winter Blyth found that in milk the Rideal-Walker coefficient was reduced from 2.2 to 1.

In regard to the increase in the lethal action of chlorine gas, when ammonization is employed, in Experiment No. 8, using chlorine as bleaching powder solution, sterilization in a 1 in 10,000 pollution is effected by three parts per million of chlorine, and in Experiment No. 16 under the same conditions, but employing gas and ammonization, this is attained by one part per million. In addition, a palatable water is produced (*vide* Experi-

ment No. 19), the phenomenon of inhibition does not present itself, and apparently the natural deviation of the water can be ignored.

This enhanced action does not appear to be due to alteration in the PH value of the water set up by the chemicals, and, as Rideal points out, ammonia compounds are endowed with special penetrative powers. It appears feasible that the organisms or colloids in intimate contact with them take up ammonia first, and on appearance of chlorine gas chloramine or other chlorine ammonia group compounds are produced *in situ* and exercise their maximum effect.

The superiority of chlorine gas over chloros and bleaching powder is brought out by these experiments.

Experiment No. 15 demonstrates that bleaching powder stands fourth in order of efficiency as a chemical sterilizer of water, and this calls for serious consideration. The difficulty of using chlorine gas instead of bleaching powder with the regulation water cart should not be insuperable, and a suggestion, which may prove to be the solution, has been forwarded to the War Office.

It is hoped that this investigation, imperfect in many details, may be of use in assisting in the advance of knowledge in the increasingly important field of chlorination. To many interested in this subject, it would appear that the repetition of certain somewhat stereotyped stock chemical equations does not satisfactorily explain the process in all its intricate phases, and that further inquiries would be amply rewarded.

Finally, by a series of experiments, it has been found that the addition of a quarter to half a part of ammonia per million to water prior to its exposure to chlorine gas increases its lethal action, and subsequent tests against various types of pollution have confirmed this fact. A process of such extreme simplicity, capable of universal application, must appeal to all interested in the use of this chemical and its compounds.

We are indebted to Lieutenant-Colonel N. E. Dunkerton, D.S.O., R.A.M.C., Officer Commanding Army School of Hygiene, for his kindly interest and suggestions, and for giving us every facility for the performance of this work, often at great inconvenience to himself; also to the staff of the Bacteriological and Chemical Laboratories, particularly Corporal Taylor and Private Bowrey of the Royal Army Medical Corps.

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- [3] RIDEAL, S. and E. "Chemical Disinfection and Sterilization," pp. 80, 82, 186, 187, 189, 192, 194, 195, 200.
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BACTERIOLOGY IN THE NEXT WAR.

BY MAJOR M. B. H. RITCHIE, D.S.O.

Royal Army Medical Corps.

I.

IN war, an army is opposed not by one enemy but by two. One is the hostile enemy, and the other, an enemy common to both armies, is disease. In this sense an army fights on two fronts. On the military front it can assume the offensive or rest on the defensive at the will of its commander, though victory is to be won only as the result of offensive action. But on the disease front a steady defensive must ever be maintained, for the initiative rests always on the side of disease.

An army in the field possesses eyes and ears, important organs, necessary for the attainment of victory, which are represented on its military front by aircraft, intelligence, cavalry, cyclists, tanks and other mobile troops ; on the disease front the eyes and ears of an army, less fully developed, are located chiefly in its mobile laboratories.

II.

An important aspect of military medical administration in future wars is the development of these eyes and ears, in order to "speed up" and facilitate two essentials required for the adequate protection of an army against disease—early, accurate diagnosis and early disease detection, carried out among the troops in the front line when the soldier first reports sick, and not after arrival at the casualty clearing station. The able and interesting article on "Laboratory Diagnosis in the Tropics and Sub-tropics in War Time," contributed to the ROYAL ARMY MEDICAL CORPS JOURNAL by Major Philip Manson-Bahr, D.S.O., merits our close attention, as it demonstrates the value of mobile diagnosis units to a force, and shows clearly that the bacteriologist and his laboratory cannot continue to be restricted to the back area of an army and the lines of communication, as his presence is equally required in the midst of the fighting troops. In the next war the bacteriologist and his laboratory, more mobile and forming part of an expanded service, may become a permanent addition to the R.A.M.C. of an infantry division.

III.

Major Manson-Bahr suggests also that the regimental medical officer should be equipped with microscope, stains and slides. This raises another point which will require consideration, and that is whether the divisional medical units and the regimental medical officers are to continue to work

under the professional limitations necessarily imposed upon them during the late war or whether, more particularly as regards means of carrying out scientific diagnosis and treatment, they should be equipped with instruments and material formerly considered unnecessary and unsuitable for the forward area.

IV.

Bacteriology is a science, which is capable of rendering great service to the high command of an army in the conservation of fighting man-power, by early detection of commencing epidemic disease. It can do this more effectively if it is more universally employed in the forward area. The present establishment of mobile laboratories is one hygiene and two bacteriological for each army. (Casualty clearing stations are provided with laboratory equipment.) On this scale one bacteriological laboratory serves two corps and this does not appear sufficient to allow of effective employment, more especially in Eastern theatres. So essential has the laboratory become to the profession that even now it is doubtful whether a mobile medical unit such as the field ambulance can fulfil efficiently all the functions that it may be called upon to perform in war if it continues without laboratory equipment. Able to operate along the simple, straight-forward lines of action like the collection and evacuation of casualties, but unable without outside assistance to pierce the gloom of difficult diagnosis, as in malaria and other diseases that cripple an army in war, *is not a field ambulance without laboratory equipment in the same condition as a motor-car without headlights?*

V.

The principle of evacuation, the foundation of medical policy in war, is partly responsible for the retention of the bacteriologists in the rear of an army.¹ The speedy removal of the sick and wounded from the fighting troops limits the professional scope of the regimental medical officers and those of the field ambulances, as their duty towards the serious case is to evacuate him as soon as possible. The presence of a medical officer with a battalion in the line is necessary, but more perhaps on account of reasons connected with hygiene and *moral* than with medicine and surgery, as in those his duty is little above what is termed "First-aid." As the late war progressed the scope of the field ambulances was narrowed by the rise in importance of the casualty clearing stations, first with regard to surgery and later with regard to medicine, as, for example, when a casualty clearing station was set apart for the investigation and treatment of dysentery cases occurring in divisions.

¹ Note.—The principle of evacuation tends to keep all specialists "down the line;" the patient being evacuated if requiring specialist advice. Within certain defined limits this tendency has to be watched. Evacuation of cases requiring specialist's advice can be overdone.—M. B. H. R.

Thus it came about that the infantry division, a community of 15,000 souls with about thirty-five medical officers on its establishment, was devoid of specialist or scientific personnel and equipment, though every kind of specialist assistance was available for the use of this community a few miles away to the rear. There was no microscope nearer to the line than the casualty clearing stations and mobile laboratories. Motor transport enabled the bacteriologists to visit divisional areas when required, and this arrangement worked satisfactorily in France where communications were good and the casualty clearing stations within a few miles of the line.

In the case of the dental service which was located at the casualty clearing stations, it has now been recognized that the community of 15,000 requires a permanent dental establishment of its own up in its midst. It appears equally important for the bacteriological service to be represented in the division also.

VI.

The future rôle of bacteriology and the bacteriologist in medicine is apparent even now in routine peace duty in the wards of a military hospital in a tropical or sub-tropical station. An officer in charge of cases of commencing tropical diseases—"N.Y.D. pyrexia" for example—if not himself doing bacteriological work, is dependent on the bacteriologist for the early accurate diagnosis of his cases. If use is not made of the scientific methods of investigation which are available, diagnosis is based on what is little more than guess-work. A good clinical sense is a valuable asset, but in tropical diseases it does not possess the same range of action as the laboratory. Diagnosis was determined formerly by the consideration of physical signs, symptoms and progress of a case, and was confirmed or not by the laboratory findings; but the process has become reversed, as it is the laboratory that is the chief factor in diagnosis, symptoms and physical signs having become supplementary because the essential point is the identification of the organism causing the disease.

The physician, suspecting some disease and requiring confirmation of his opinion, would call in the bacteriologist; nowadays it is frequently the bacteriologist, seeing and investigating cases in the early stages, who puts the physician on his guard. The microscope has supplanted the stethoscope and the bacteriologist has begun to supplant the physician; the former (the bacteriologist) is the complement of the latter, for a physician in charge of tropical and many other types of cases, if not himself carrying out laboratory methods of diagnosis, cannot move along his ward from bed to bed and investigate cases intelligently on modern scientific lines without a bacteriologist beside him. At the present day "the Lab's the thing."

VII.

As the great war period recedes slowly from us, we have to readjust our orientation of medicine to future wars in accordance with changing

conditions and the advance of the scientific side of the profession. What was not required in the medical organization of an army in 1918, or was too elaborate or non-portable for use at the front, may have become an essential and a matter of everyday routine before another British army takes the field. The new generation of medical men will be better instructed and more competent to undertake bacteriological work as it becomes more generally employed in practice and more relied upon for diagnostic purposes. The microscope will become an instrument which the regimental medical officer cannot do without, and the more tropical the theatre of war the more indispensable does the microscope become. The absence of the microscope from the divisional medical units of the great war is remarkable; the provision of microscopes was never suggested in France so far as the writer is aware. It is interesting, however, to recall that in India fifteen years ago the then Director of Medical Services considered that the microscope was a necessary article of the regimental medical officer's equipment.

The mobile laboratory in France, having to deal with the needs of two or more corps and several casualty clearing stations, surrendered its mobility and overflowed into a building in order to become a large central institution. In the next war it must regain its mobility and limit its sphere of action to a smaller formation, probably the division (or its equivalent in man-power if another type of formation is created). Expansion of the bacteriological service will take place; early, accurate diagnosis and early disease detection are factors of immense administrative importance which cannot be effectively realized without an expanded service.

VIII.

In the majority of diseases that menace the man-power of an army in war, a scientific diagnosis is obtainable in the commencing phases of the illness—in some cases it is more accurately made then than later. And in the case of an early-recognized illness, treatment on the correct lines can be commenced at a time when it is most likely to bring about an early cure. Also, pathological specimens do not travel well, and communication between divisions and rear medical units does not permit of the rapid dispatch of specimens and the early notification of results.

Taking these points into consideration, it is obvious that the patient and the bacteriologist must be within reasonable distance of each other, so that the patient can be attended in the early stages of his malady and the bacteriologist can deal with fresh specimens.

IX.

A consideration of the potentialities of bacteriology in future wars will demonstrate how important it is likely to become. If the high command of an army in the field is to obtain full value from its medical service; the

more general employment of mobile laboratories is essential. Whether a lighter type of vehicle will be employed, working in close communication with more elaborate institutions in rear, whether one field ambulance of a division will have a laboratory attached, and whether the distinction between the hygiene and the bacteriological laboratories will continue under future war conditions, are matters of technical administration that are outside the limit of this article. But the routine bacteriological examination of water supplies used by the troops at the front may become necessary in the future in order that an army may know the quality of water it is drinking, and whether purification is effective; if so, this is another rôle for the divisional mobile laboratory to play.

X.

The bacteriologist and his laboratory belong to that important group of units termed the eyes and ears of an army, and under some circumstances may be as necessary for the attainment of victory in the field as any other member of the group. The laboratory is a medical unit; it is in effect a valuable agent in the conservation of fighting man-power, and its military aim is to protect each individual soldier in a force from disease, so that on the day of battle he may be at his post and not in a hospital bed.

On this assumption the mobile laboratory is a unit to be employed in the forward area where its presence is most required, and one that must take the risk of being put out of action by hostile shelling. And its replacement is relatively less costly than most of the other eyes and ears of an army. "Good laboratories and plenty of them" is an axiom of medical administration in future warfare; with the assistance that increased bacteriological facilities can afford, we shall be enabled to go a long way towards the solution of problems that still baffle us in our endeavours to maintain a successful defensive on the vulnerable disease front of an army in war. Without this assistance a medical service will be working only by candlelight.

AN AREA MEDICAL EXERCISE.

BY COLONEL E. T. F. BIRRELL, C.B., C.M.G.

THE following medical exercise was prepared as part of the winter scheme of training 1923-24, for regular officers, Royal Army Medical Corps, serving in the South-Western Area, Southern Command, and was carried out at Devonport in November, 1923. The notes on each task were issued to the officers taking part after they had handed in their work, and conferences followed, the results of which are embodied in the comments on officers' work.

The general idea in this exercise is taken from another exercise contributed to the JOURNAL OF THE ROYAL MEDICAL CORPS by Major R. L. V. Foster, R.A.M.C., and myself, and the situations are in continuation of that exercise.

I am indebted to Major and Brevet Lieutenant-Colonel A. L. Ransome, D.S.O., M.C., D.A.A. & Q.M.G., South-Western Area, for preparing the tactical part of the scheme.

References: Provisional War Establishments, Part XXIII A, June 1, 1923; Field Service Regulations, vol. i, 1923; Field Service Regulations, vol. ii, 1920 (especially Chapter VI, operation orders); Training and Manœuvre Regulations, 1913 (especially Section 14, appreciations), and R.A.M.C. Training, 1911.

GENERAL IDEA.

Reference 1 inch O. S. Map, Sheet 148, and General Map of England.

On June 12, 1923, Eastland, comprising the counties of Hampshire, Wiltshire, Dorset, and Somerset, with capital at Salisbury, declared war on Westland (capital Plymouth), comprising the counties of Devon and Cornwall. On June 13, the Eastland fleet heavily defeated the Westland fleet off the coast of Devon, and blockaded it in Plymouth harbour, where it had taken refuge. On July 26, the main armies of Eastland and Westland came into contact about thirty miles north-east of Exeter. Fighting was heavy but undecisive.

On July 29, an Eastland division was landed at Dartmouth and Salcombe with orders to march on Plymouth. Their advance was held up on the River Erme by the 3rd (Cornish) Division (newly mobilized at Plymouth) until August 1, when, the enemy having been strongly reinforced, the 3rd (Cornish) Division retired to the north of Plymouth, which was occupied by Eastland troops on August 2.

Note.—*Moral* and armament of forces of Eastland and Westland approximately equal and similar to that of the British Army.

SPECIAL IDEA.

(1) On August 1, general headquarters, Westland, issued orders for the formation of the III Corps, consisting of the 3rd (Cornish) Division, 4th (Launceston) Division, and 5th (Devon) Division.

(2) On August 3, the III Corps was located as follows :—

4th Division, in touch with the enemy along the line Bere Alston—Buckland Abbey—Yelverton—Meavy. 3rd Division, in reserve in the Tavistock area, after relief by 4th Division. 5th Division, mobilizing at Okehampton, and expected to be ready to move on August 5. Corps Headquarters at Tavistock. There has been a pause in Eastland's offensive since the morning of August 3.

(3) The general officer commanding III Corps, in pursuance of the plan of general headquarters, Westland, to retake Plymouth, ordered the following dispositions to be complete by 06.00 hours, August 6, preparatory to assuming the offensive on the morning of August 7 :—

(a) The 3rd Division to be established on the line Buckland Abbey—Hellington—Yelverton, relieving the 4th Division on that part of the Corps front. Headquarters at Horrabridge. (b) The 4th Division is to be established on the line Yelverton (exclusive)—Meavy—Gutter Tor. Headquarters at Walkhampton. (c) The 3rd and 4th Divisions to be ready to attack on the morning of August 7. (d) The 5th Division in reserve in the Tavistock area. (e) Corps Headquarters to remain at Tavistock.

(4) Reinforcements for the 3rd Division to replace casualties were due to arrive at Tavistock on August 5.

(5) Corps railhead is Tavistock. Casualties are to be evacuated by motor ambulance convoy to Tavistock under Corps arrangements.

(6) In pursuance of the above the general officer commanding 3rd Division orders the following dispositions of his division :—

(a) 7th Infantry Brigade, the line Buckland Abbey—Hellington (inclusive). (b) 8th Infantry Brigade, the line Hellington (exclusive)—Yelverton. (c) 9th Infantry Brigade in divisional reserve at Horrabridge. (d) Divisional artillery (less forward batteries) in positions east of Buckland Monachorum.

REQUIRED : FIRST TASK.

As assistant director of medical services, 3rd (Cornish) Division, having been informed of the orders and arrangements mentioned in the Special Idea, write an appreciation of the situation, showing how you would place your field ambulances and divisional sanitary section.

Note.—The medical units of the Division are the 7th, 8th, and 9th Field Ambulances, and the 3rd Divisional Sanitary Section.

NOTES ON FIRST TASK.

The appreciation required might be on the following lines :—

The situation is that the 3rd (Cornish) Division is to move into the

line from rest at Tavistock on August 6, with a view to attacking on August 7. The assistant director of medical services is informed of this on August 3.

The object of the assistant director of medical services is so to locate his medical units as will best serve the division, not only in the position it is to take up, but in the subsequent operations against Plymouth.

Therefore, his ambulances should be in positions suitable for the earlier phases of the battle, and be kept readily mobile (e.g., not filled with slight cases), and, in the hilly country which the division is to occupy, it is important that they should be on roads accessible to motor transport. There are no particular indications for placing the sanitary section elsewhere than immediately at hand, i.e., near divisional headquarters.

The division has probably a number of footsore and tired men, who only need a few days' rest to be able to return to duty. He can propose a divisional rest camp for them, in which they can be left when the division moves south to its position. He should arrange for their medical care, but must see that their retention does not diminish the mobility of his units.

It will serve immediate purposes if he first selects sites for main dressing stations, so that they may be allotted by divisional headquarters, leaving the question of advanced dressing stations to be determined after reconnaissance of the ground. Two field ambulances will suffice for the troops in the line. If placed on or near the main road, to which the roads leading from the front converge, casualties could be brought to them by field ambulance transport, horsed or mechanical according to the nature of the roads leading from the front, while the main road would facilitate evacuation by motor ambulance transport. Main dressing stations should not be too far forward, nor with this narrow front need they be far apart.

He might therefore propose to place two ambulances, say the 7th and 8th Field Ambulances, at Mill, a few hundred yards south of the Horrabridge—Walkhampton road, which by the map seems suitable, being near main roads, but not actually on them. The 7th Field Ambulance would serve the area of 7th Infantry Brigade, and the 8th Field Ambulance the 8th Infantry Brigade. The 9th Field Ambulance should be in reserve and for local duties at Horrabridge, where also the divisional sanitary section should be placed in the first instance.

COMMENTS ON OFFICERS' WORK: FIRST TASK.

Several officers chose sites for main dressing stations in the neighbourhood of Pound, west of the main road. It was pointed out, however, that there might be difficulty during the expected action in getting the medical units on to the main road, owing to the movements of troops, guns, and

brigade transport on the side roads, whereas traffic control on the main road would probably be divisional and specially regulated.

NARRATIVE.

(1) By 04.00 hours, August 6, the 3rd and 4th Divisions had taken up the frontage assigned to them, and their patrols were in touch during August 6 with hostile advance troops, who maintained a passive attitude.

(2) Westland aircraft reported during August 6 signs of new entrenchments in the following areas, and many working parties seen: Roborough Down, Wigford Down, Upperton, and Shaugh Moor. Considerable movement was observed in Plymouth, and on the Plymouth-Roborough and Plympton-Bickleigh roads. The triangle Ridgeway—Ivybridge—Cornwood was reported clear of the enemy.

(3) In pursuance of his plan for the recapture of Plymouth, the general officer commanding III Corps issued orders at 09.00 hours, on August 6, as follows:—

(a) 3rd and 4th Divisions to assume the offensive at 05.00 hours, August 7.

1st objective: Point 333, Porsham—Road junction point 507, $\frac{1}{4}$ mile South of Roborough Inn—Bickleigh Bridge—Faunstone—Lee Moor.

2nd objective: Point 332, Tamerton Folliott—Crownhill cross roads—Plym Bridge—Boringdon—Hemerdon Ball. Dividing line between 3rd and 4th Divisions: the Yelverton-Plymouth railway (inclusive to 4th Division).

(b) 5th Division to move from Tavistock (where it had arrived by 22.00 hours, August 5) to the area Horrabridge—Walkhampton, there to be in Corps reserve. (c) Corps headquarters to open at Yelverton on capture of the first objective.

(4) In pursuance of the above, the following is a summary of the orders issued by the general officer commanding 3rd Division:—

(a) The attack is to be carried out on a two-brigade front, 7th Infantry Brigade on the right, 8th Infantry Brigade on the left. Dividing line between brigades: Sowton—Road junction point 633—Roborough—Crownhill road (inclusive to 7th Infantry Brigade). (b) 9th Infantry Brigade in divisional reserve at Horrabridge. (c) Divisional artillery (less forward batteries) in positions east of Buckland Monachorum. Later moves dependent on the situation. (d) Headquarters, 7th Infantry Brigade, at zero hour at Crapstone. Headquarters 8th Infantry Brigade, at zero hour at Yelverton. Headquarters of both infantry brigades to follow the Yelverton-Crownhill road when they move forward. (e) Divisional headquarters will move to Lodge at point 633 on the Yelverton-Crownhill road on capture of the first objective.

Note.—Field ambulances are located as in Notes on First Task. Advanced dressing stations are open at road junction point 473 (7th Field Ambulance), and Retreat (8th Field Ambulance).

REQUIRED: SECOND TASK.

As assistant director of medical services, 3rd (Cornish) Division, write an R.A.M.C. order in view of the above summarized divisional order.

Note.—The instructions issued by headquarters, III Corps, included in the medical paragraph information that the ambulances of the 3rd (Cornish) Division will be cleared by the 6th Motor Ambulance Convoy (at Tavistock), and that the assistant director of medical services should arrange direct with the convoy commander.

NOTES ON SECOND TASK.

The fighting is likely to be severe. The country is hilly and much cut up by valleys. The most advantageous route for clearing casualties would be towards and along Yelverton-Crownhill road. If divisional headquarters agree that this main road can be so used, e.g., at certain stages of the fight, the general plan of the medical arrangements might be for the companies of field ambulances to follow the fighting troops, while the headquarters of ambulances remain near the main road, clearing their advanced dressing stations with their own ambulance transport, and themselves being evacuated by the motor ambulance convoy at the disposal of the assistant director of medical services. As the troops move forward, main dressing stations should also move forward, as necessary, along the main road. Their movements should be controlled by the assistant director of medical services, who can ascertain from divisional headquarters when they can take place. The order might read as follows:—

3RD (CORNISH) DIVISION.

R.A.M.C. Order No. —.

SECRET.

Copy No. —

(Issued reference 3rd (Cornish) Division Order No. —.)

August 6, 1923.

Reference 1 inch O.S. Map, Sheet 148.

(1) (a) Enemy troops have been located on Roborough Down, Wigford Down, Upperton, and Shaugh Moor.

(b) The position of our troops is unchanged.

(2) (a) The 3rd (Cornish) and 4th (Launceston) Divisions are to assume the offensive at 05.00 hours, August 7, with a view to retaking Plymouth; dividing line between 3rd and 4th Divisions, the Yelverton-Plymouth railway (inclusive to 4th Division). *1st objective of 3rd Division:* Point 333, Porsham—Road junction point 507, $\frac{1}{4}$ mile S. of Roborough Inn. *2nd objective:* Point 332, Tamerton Folliott—Crownhill cross roads—Plym Bridge.

(b) The attack is to be carried out on a two-brigade front, 7th Infantry Brigade on the right, 8th Infantry Brigade on the left; dividing line:

Sowton—Road junction point 633—Roborough—Crownhill road (inclusive to 7th Infantry Brigade). 9th Infantry Brigade in reserve at Horrabridge. Division artillery (less forward batteries) in position east of Buckland Monachorum.

(c) At zero hour Headquarters 7th Infantry Brigade will be at Crapstone, Headquarters 8th Infantry Brigade at Yelverton. Both headquarters are to follow the Yelverton-Crownhill road when they move forward.

(3) (a) 7th Field Ambulance will clear the area of 7th Infantry Brigade, 8th Field Ambulance will clear the area of 8th Infantry Brigade. Each of these field ambulances will detail one officer and two other ranks to report to the respective infantry brigade headquarters at zero hour for liaison duty.

(b) At zero hour field ambulances will be in position as follows :—

(i) Headquarters 7th and 8th Field Ambulances (each less two companies) at their present site, Mill, 300 yards south of the Horrabridge-Walkhampton road.

(ii) Two companies, 7th Field Ambulance, at road junction point 473.

(iii) Two companies, 8th Field Ambulance, at Retreat.

(iv) 9th Field Ambulance in reserve at Horrabridge.

(4) As the troops move forward, the companies of 7th and 8th Field Ambulances will follow up and form advanced dressing stations as required, the sites of which will be immediately reported to the A.D.M.S. Officers commanding field ambulances will arrange to clear these advanced dressing stations. Headquarters of 7th and 8th Field Ambulances will be prepared to move to new positions along the Yelverton-Crownhill Road at half-an-hour's notice. Orders for moves of headquarters of field ambulances will be issued by the A.D.M.S.

(5) The clearance of main dressing stations will be arranged by A.D.M.S.

(6) Reports showing numbers for evacuation in main dressing stations will be sent to the A.D.M.S. at divisional headquarters at 08.00, 11.00, 14.00 and 17.00 hours.

(7) Divisional Headquarters will be at Horrabridge until capture of the first objective, then at Lodge at point 633 on the Yelverton-Crownhill road.

(8) Acknowledge.

H. J. Major,

D.A.D.M.S., 3rd (Cornish) Division.

Issued at 13.30 hours.

Issued to: 7th F. Amb. Copies to: G.

8th F. Amb.

9th F. Amb.

A. and Q.

H.Q. 7th Inf. Bde.

H.Q. 8th Inf. Bde.

H.Q. 9th Inf. Bde.

6th M.A.C.

D.D.M.S. III Corps.

D.M.S.

War Diary

File

COMMENTS ON OFFICERS' WORK: SECOND TASK.

There was a tendency in the orders written to name sites for advanced dressing stations. It was pointed out at the conference that as the actual course of the fight could not be definitely foretold, it would have been better to leave the selection of these sites to the ambulances themselves. Some indicated sites for main dressing stations, for example, near Lodge at point 633, to which headquarters of ambulances were ordered to move after capture of the first objective. Although the sites named were such as probably would have been selected, it was considered unlikely that the ambulances would have been able to move up to them on their own initiative, as probably they could not have advanced along the main road without special arrangements by divisional headquarters.

The orders contained much detail as regards liaison with the assistant director of medical services, liaison with and assistance to battalions, the disposal of "N.Y.D.N." and other special cases, and the nature of the reports required, which tended to lengthen the orders and would, in actual war, have been embodied in standing instructions. The preparation of such instructions would be an interesting exercise.

DEVONPORT,

November 16, 1923.

THE HANDLING OF CASUALTIES FROM CHEMICAL WEAPONS.¹

BY MAJOR W. R. GALWEY, O.B.E., M.C.
Royal Army Medical Corps.

THE correct handling of casualties depends, firstly, on accurate knowledge of the severity, course and proper treatment of the illness which arises from any particular type of war gas: in other words, on correct diagnosis, prognosis and therapeutics—as with any other malady, and, secondly—and of more importance for the welfare of the Army as a whole—on knowledge of the tactical use of gas. Let me illustrate the importance of this latter knowledge.

If your casualties are mostly from a mustard gas bombardment it is unlikely that the enemy is going to advance, because mustard gas being persistent renders ground untenable. It may not, therefore, be necessary to clear your front line medical units, and you can hold on to your cases. If, on the other hand, the enemy bombards with lung irritants or the chlorarsines it is probable that he is going to advance, and you must clear your medical units of all cases which it is safe to move.

To decide which cases should be evacuated and which retained, sound knowledge of the effects of the various types of gases is essential. The first duty of the medical officer is to prevent unnecessary wastage.

Gas is a terrifying weapon and large numbers of men, especially amongst raw troops and troops who have been injudiciously trained, when subjected to a heavy bombardment, will report sick believing they have been gassed, when in reality they have only smelt gas in a concentration which would do them no harm, or have smelt the fumes of high explosive. Again, when troops have been subjected to the heavy strain of prolonged bombardment or fighting, it will only need a small dose of gas—so great is its moral effect—to precipitate a nervous breakdown. The majority of these cases if given a rest and firmly handled, will be fit to return to their units in a short time and need never leave the divisional area. It is stated, by those best qualified to speak, that a dose of gas sufficient to cause harmful results will from the first reveal some sign to the trained observer which will enable him to decide how to dispose of the patient.

Experience in the late war led to the following classifications of gas casualties:—

- (1) Slight: lachrymators and chlorarsines.
- (2) Early acute: lung irritants.
- (3) Late acute: vesicant.

In each of these classes answers have to be found to these questions:—

¹ Excerpt from a lecture given at the Royal Army Medical College.

Should they be evacuated?

When should they be evacuated?

How should they be evacuated, i.e., as lying or sitting cases?

Of course every rule must necessarily give way to urgent military situations, but speaking broadly in each class certain principles can be laid down for guidance.

In the case of the lachrymators and chlorarsines as a rule the disability is transitory and patients may be returned to duty in a period varying from a few hours to a few days, though in a few instances general toxic symptoms develop which necessitate evacuation to the casualty clearing station zone or to lines of communication units. For such cases special centres which can serve as divisional or corps treatment and rest stations are most advantageous.

In the case of the lung irritants, pulmonary oedema develops early though its onset may be insidious. The first and second questions may therefore be answered by saying that all cases where definite signs and symptoms of damage appear should be evacuated, and that evacuation from forward medical units, whether field ambulances or casualty clearing stations should be delayed for forty-eight hours.

If the patients develop cyanosis and oxygen administration is necessary, they should, if possible, be retained until convalescence is definitely established, respiration, temperature, and pulse being taken into consideration, and the pulse, which always shows tachycardia in convalescence, being looked upon as the most important of these. The answer to the third question is that all cases of irritant gas poisoning should when possible be evacuated as lying patients from the time of gassing until convalescence is advanced.

The late acute cases—the vesicants—give more time and opportunity to arrange for serious developments. In mustard gas poisoning the lung trouble, broncho-pneumonia, does not develop before the third day and the early skin lesions are no contra-indication to the patient walking from the front line and being subsequently sent on as a sitting case. Once, however, broncho-pneumonia or serious septic infection has set in, he must of necessity be treated as any other serious case. The most urgent point in dealing with mustard gas casualties is to arrange for prompt disposal of the case and disinfection of the patient and his clothing so that he may not further infect himself or infect others.

So urgent and important did the problem of handling gas casualties become—they numbered some twenty per cent of the total towards the end of the war—that the French and Americans each organized special units for their reception.

The British only partially adopted this procedure. Some divisions told off field ambulances for the reception of gas casualties and similarly corps detailed casualty clearing stations for this purpose. These units had certain special equipment and numbered in their personnel medical officers

and other ranks who were highly skilled in the treatment of gas poisoning. They answered their purpose well in normal periods of trench warfare, but in rush periods and in a war of movement it was found impracticable to sort out and segregate the gas cases from others and to transport them to special units.

In such times, therefore, it became necessary to distribute equipment and trained personnel as widely as possible and to the best advantage, and to endeavour to ensure a high standard of knowledge of gas poisoning amongst front line field ambulances. The above objections did not apply to the same degree at the base. At certain bases special hospitals were designated for the reception of gas cases, not so much in order to arrange for special treatment for the most serious cases—the early acute cases resulting from lung irritants had to be treated further forward—but because at the base it was possible to make a more accurate study of such problems as the length of stay in hospital and period of convalescence and subsequent degree of disability. Once the treatment of gas casualties was thoroughly understood it was found that a large percentage of cases made a rapid recovery and were able to return to full duty.

As I pointed out when dealing with the vesicants, neuroses are common and troublesome sequelæ. Functional blepharospasm, aphonia, indigestion and disordered action of the heart were prevalent amongst patients recovering from mustard gas poisoning. But once the true significance of these disabilities was appreciated and treatment was based on sound psycho-therapeutic lines, they became less frequent and it was found that the stay in hospital and period of convalescence were greatly reduced. This lesson was more quickly learnt in France than in England, where cases were widely scattered and under the care of medical men who had little special training, and so in many instances patients were kept for lengthy periods under medical care to the great detriment both of the individuals themselves and also of the country. In the future, therefore, should a similar situation arise, it is very necessary that gas patients evacuated from overseas should be sent to special hospitals in this country which should be staffed by medical men with special training.

The second problem of medical administration is the organization of treatment.

Many of the slight cases—lachrymators and chlorarsines—need never go further back than the regimental aid post. As regards the lachrymators, no treatment beyond removal from the gas need be applied in the majority of cases. A whiff or two of chloroform will relieve the pain in the nose, throat, and teeth, caused by the chlorarsines. In the case of the early acute cases—the lung irritants—the organization of treatment is more difficult. The essentials are *rest*, *warmth*, and *oxygen*. Rest can be ensured by evacuating as lying cases, warmth by blankets, hot-water bottles, etc.; but the provision of oxygen at the front, or even to field ambulances, is more difficult. For, though the Haldane oxygen delivery

apparatus makes administration easy, the quantity of oxygen necessary is enormous, and its supply is largely a matter of transport. The usual cylinders are bulky and heavy. During the war the Air Force had special light cylinders for pilots flying at high altitudes, and at present one of the problems which is engaging the attention of the Oxygen Research Committee is the provision of a light cylinder which will be sufficiently strong to withstand the high pressure developed when it is fully charged.

In casualty clearing stations and field ambulances acting as such, it is possible to arrange for special wards where an oxygen supply can be arranged with delivery pipes over each bed.

Even if oxygen is not available in quantity, early venesection may relieve the blood concentration resulting from the pulmonary oedema and benefit the patient; and this procedure should be carried out at aid posts and dressing stations when the patient's condition indicates the onset of serious symptoms of lack of oxygen.

The third group of cases, the late acute caused by vesicants, should be placed in fully equipped wards before urgent symptoms develop. The urgent need in the field units—regimental aid posts and field ambulances—is to remove and dispose of the infected clothing and relieve the early eye and skin lesions. I have already dealt in my first lecture with the disinfection of clothing contaminated by mustard gas. It should be possible with mobile disinfecting units to arrange for this close to the front. The eyes should be bathed and the patient washed over with a two-per-cent solution of bicarbonate of soda.

When special units are detailed for the reception of gas casualties, accommodation should be organized so that cases can be sorted, their clothing disposed of and treatment initiated without delay.

Accommodation should, therefore, consist of a receiving room, a room for contaminated clothing, a lavage room, and wards for serious and light cases.

Organization of treatment should extend beyond the acute illness into convalescence whether the patient remains overseas or is evacuated to the United Kingdom. It is necessary to arrange for graduated exercise for the cases of lung irritant poisoning who suffer from "effort syndrome," and for administration of oxygen to those who suffer from nocturnal dyspnoea. It is also necessary to arrange for the re-education of the convalescents who develop conversion hysterias after either vesicant or chlorarsine poisoning.

If in war we are to deal adequately with administrative problems such as those which I have indicated above, we must have adequate training in peace. This training would naturally fall under the following headings:—

- (1) The training of medical officers.
- (2) The training of other ranks, R.A.M.C.
- (3) The training of stretcher bearers.
- (4) Medical aspects of the general training of troops in gas defence.

(1) TRAINING OF MEDICAL OFFICERS.

In the late war one of the chief difficulties of the medical services was dissemination of intelligence regarding the effects of poisonous gases and their treatment. This was inevitable in view of the secrecy which had to be maintained regarding the gases used, but apart from that we have, I hope, learnt the lesson that a special organization is necessary to disseminate medical intelligence regarding prevention and treatment of diseases and injuries which may cause serious wastage. The beginning of such an intelligence service has been made in the institution of hospital or district libraries.

At present no official manual dealing with the medical aspects of gas warfare is available, but the official medical history is now published. These lectures on gas warfare are also part of the course of instruction for officers attending the Royal Army Medical College.

(2) TRAINING OF OTHER RANKS, R.A.M.C.

The chief points to be attended to are:—

- (i) The disinfection and disposal of clothing contaminated by mustard gas.
- (ii) The sorting of gas casualties into serious and light cases.
- (iii) The provision of oxygen equipment and of wards for the administration of oxygen.
- (iv) The technique of venisection and saline infusion.
- (v) The instruction of other ranks in the application of defensive apparatus to wounded and helpless patients.

(3) TRAINING OF STRETCHER BEARERS.

Medical officers in charge of troops when training regimental stretcher bearers in first aid, should instruct them in the handling of and first-aid treatment for gas casualties, laying stress on the necessity for evacuating as lying cases casualties from the lung irritants, and the precautions to be adopted in handling the clothing and equipment of patients contaminated by mustard gas.

(4) MEDICAL ASPECTS OF THE GENERAL TRAINING OF TROOPS
IN GAS DEFENCE.

In addition to the training of Royal Army Medical personnel in gas defence, medical officers in charge of troops should pay attention to such points as the effects on efficiency brought about by wearing respirators and the periodic cleansing and disinfection of respirators. The respirators of patients evacuated to hospital with infectious disease should be disinfected in the appropriate manner when the remainder of their kit is dealt with.

Finally, in all manœuvres and camps of exercise, training in the medical aspects of gas warfare should have a place.

What the Medical Organization in a future war will be it is at present impossible to say. In the late war no special organization existed on the medical side in France—though treatment was supervised both at the front and bases by consultants who had special knowledge, and liaison was maintained between the medical and gas directorates. It appears, however, that if chemical weapons are again used—and it seems to be inevitable that they will be in any great future war—it will be necessary to organize a specialist Gas Medical Service on the lines of the specialist Service in Hygiene and Pathology. It will be of vital importance, firstly, to ensure that close liaison is maintained with research workers at home and in the field, so that information regarding the effects of new compounds and their treatment may reach the medical officers most concerned; and, secondly, to organize the handling and treatment of casualties.

We know what gas warfare was in the late war, and we know its possibilities in the future. We should not neglect any measure which will minimize suffering and wastage.

A NOTE ON THE TYPES OF PNEUMOCOCCUS FOUND IN THE PUNJAB AND NORTH-WEST FRONTIER PROVINCE OF INDIA.¹

BY CAPTAIN R. H. MALONE, M.D. I.M.S.

(On Special Duty under the Indian Research Fund Association.)

UP to the present day no records exist of the types of pneumococcus found in lobar and broncho-pneumonias in India.

In view of the evidence of Lister that a fairly common type of pneumococcus exists in South Africa and appears to be peculiar to that country, it was thought advisable to classify the pneumococci found in the pneumonias occurring amongst Indian troops in the Punjab, Waziristan and Baluchistan.

The classification was carried out by means of the agglutination test with sera supplied by the Rockefeller Institute of Medical Research, New York, and by Dr. Wadsworth of the State Health Department, New York.

In the Punjab and Waziristan, forty-six strains obtained from the washed sputum of pneumonia patients or from blood cultures were examined with the following results :—

Type I	:	13	:	28 per cent.
„ II	:	10	:	22 „
„ III	:	5	:	10 „
„ IV	:	18	:	40 „

In Baluchistan, sixty strains were examined :—

Type I	:	17	:	28·3 per cent.
„ II	:	8	:	13·3 „
„ III	:	3	:	5·0 „
„ IV	:	32	:	53·3 „

Total, 106 strains :—

Type I	:	23·3 per cent.
„ II	:	17·0 „
„ III	:	7·5 „
„ IV	:	47·2 „

An attempt was made to classify the Type IV strains by the method suggested by Lister and also by using the ordinary hanging drop method, using two parts of serum and one part of bacterial suspension.

The sera employed were obtained from cases of lobar pneumonia one or two days following the crisis.

¹ Published in the *Indian Journal of Medical Research*, vol. ii, No. 3, January, 1924, and reprinted by kind permission.

Altogether nine sera were tested against thirty-two strains.

Six of the sera failed to agglutinate any but the homologous strains. Two sera agglutinated a fairly large group consisting of six heterologous strains, and one serum agglutinated two heterologous strains.

None of these nine sera agglutinated any of the South African strains received from Sir Spencer Lister.

CONCLUSIONS.

(1) In the Punjab and North-West Frontier, Type I pneumococcus is a common causal agent in pneumonia. Types II and III are probably less common than in Europe or America, while fifty-two per cent of the cases are caused by strains belonging to the group known as Type IV.

(2) Among the Type IV strains there is one fairly large sub-group which includes twenty-five per cent of the strains tested and another including nine per cent. The remaining strains were agglutinated only by the homologous sera.

NOTE BY LIEUTENANT-COLONEL MARRIAN PERRY.

The above interesting paper by Captain R. H. Malone, on the classification of Indian strains of the *pneumococcus*, illustrates how closely the relative proportion of the various types agrees with that determined for Great Britain and America.

An unselected series of 100 cases of lobar pneumonia was investigated in England with the following result :—

Type of pneumococcus	...	1	2	3	4
Percentage	...	24	35	10	31

The result of examination of a series of cases in America was as follows :—

Type of pneumococcus	...	1	2	3	4
Percentage	...	33·3	29·3	13	24·4



Clinical and other Notes.

TWO CASES OF INTEREST.

BY CAPTAIN A. K. FORBES, M.C.
Royal Army Medical Corps.

Case 1.—Mrs. P., age 25, primipara, was delivered of a living male child, presentation R.O.A., on February 20, 1924. The child was perfectly formed except that on the right side of the neck a large cystic swelling was noticed extending almost from the spinal column to the anterior aspect of the sterno-mastoid muscle. The tumour was freely movable, painless and fluctuated. There were no pressure symptoms, but the child developed an irritating cough.



The differential diagnosis lies between a branchial cyst and a cystic hygroma. The photograph taken by Corporal J. W. Stewart, R.A.M.C., 36 Casualty Clearing Station, gives an excellent view of the tumour. Perhaps (from previous experience) some of the readers of the journal may be able to settle the diagnosis.

Case 2.—A case of contraction at the outlet of the pelvis obstructing labour. Mrs. S., age 24, primipara, admitted February 28, 1924, in labour. This case had been examined twice previously at the antenatal clinic and

external measurements were all found correct. The first stage of labour lasted thirteen hours, the membranes having ruptured before the patient came into hospital. Labour progressed slowly but steadily and twelve hours after the patient had been admitted the perineum was bulging. I did not examine as the case looked a perfectly straightforward one, which would terminate within the hour. To my astonishment the pains instead of increasing became weaker and within a hour or two labour had not progressed at all, and the patient began to show signs of exhaustion. I was thoroughly puzzled until I examined the patient *per vaginam*, and found an elongated caput bulging the floor of the perineum, and the head obstructed by a coccyx ankylosed at right angles to the sacrum. I broke the coccyx at the sacro-coccygeal joint with my fingers, applied forceps and delivered easily.

Those who have been reading the *British Medical Journal* lately will remember Professor Blair Bell's argument regarding the importance of measuring the outlet of the pelvis as well as the inlet, a point illustrated by this case.

ACARODERMATITIS URTICARIOIDES (GRAIN ITCH) IN TURKEY.

BY COLONEL J. C. KENNEDY, M.D., K.H.P.

Consulting Physician to the British Army.

DURING the operations in Turkey in 1922-1923 some interesting cases of dermatitis came to notice.

On October 31, 1922, six cases of chicken-pox were reported in the 3rd Hussars who were engaged in outpost duty on the Anatolian side of the Bosphorus. Careful examination, however, satisfied us that they were neither chicken-pox nor modified small-pox and the following facts were brought to light.

All the cases came from one village in which the troop was occupying billets. Certain of the villagers were known to be suffering from similar rashes and it was stated that the affection was known to them as the "grain disease."

Through the good offices of Major McKinlay, R.A.M.C., it was found that Turkish doctors recognized the disease as the "grain itch" and were aware of its prevalence in those parts at this season of the year.

All the men affected had been sleeping on straw or on floors of barns or places where grain and straw had been stored. The clinical symptoms tallied with the description given in textbooks of acarodermatitis urticarioides which is caused by the bite of the grain mite, *Pediculoides ventricosus*.

As a short and adequate description of this disease that given in Norman Walker's "Introduction to Dermatology" may be quoted: "The

eruption is usually urticarial in form, but it may resemble erythema multiforme, and in other cases the development of a vesicle at the site of attack results in a varicellum eruption. It most commonly appears on the trunk, and the hands and face are usually spared. The itching is intolerable: it becomes worse at night and seriously interferes with sleep. The temperature may be elevated two or three degrees. As a rule the itching subsides in from twelve to thirty-six hours—the mites do not breed on the human skin—and the eruption disappears in a week or ten days."

The vesicular appearance was well marked in some of the cases, hence the diagnosis of chicken-pox.

We were not able to complete the story by finding the mite. Major Bensted and myself examined several samples of grain and straw from the infected billets but discovered only one mite and that not a pediculoides. Lieutenant-Colonel MacArthur kindly identified this specimen as belonging to the genus *Glycyphagus* (species not identified), the best known species of which is the mite that causes "grocers' itch."

The following particulars of seven cases are taken from notes for which I am indebted to Captain V. J. Perez, R.A.M.C.:—

Cases A and B occupied the same billet—a cowshed in which straw had been stored. They slept on the earth floor and their rashes appeared on the same day—October 29.

Cases C and D were billeted in a small house with three civilians. C slept in a sack of local tibbin and D on the floor and both noticed the rash on October 27. One of the civilians had a similar rash.

Cases E and F were billeted in a stable in which there was wheat and straw. They slept on the earth floor and their rashes appeared on October 29 and 30 respectively.

Case G was occupying a hut along with some Kalmaks, who, he stated, were also affected. He slept on the floor which had been used for grain and his rash appeared on November 5.

The rash was practically limited to the trunk but in one or two cases was present also on the flexor aspects of the arms: a tendency to an intercostal distribution was noted in two cases. It attained its maximum in twenty-four to forty-eight hours, sometimes longer, and did not show much evidence of fading till about the fourth or fifth day.

The temperature was raised in four of the cases from 100° to 102° F. during the first twenty-four hours.

Itching varied in intensity and duration but some described it as very irritating and preventing sleep, particularly in the first twenty-four hours.

The rash consisted of red spots, tending to form groups, which in some cases ran together to form a slightly raised urticarial patch, in one case almost purpuric. The spots tended to be papular and in the centre a small vesicle developed: the vesicle was not umbilicated. In one case tiny pustules appeared.

The process of fading was slow and a slight brownish discoloration

was apparent for some time along with some desquamation and slight scabbing of the dried vesicles.

There was no constitutional disturbance beyond the temperature and discomfort during the first twenty-four hours. The urine was normal.

Owing to the uncertainty of the diagnosis in the first instance the cases were isolated; this is, of course, unnecessary, but the patient must have a bath on removing his clothes and his clothes should be disinfected.

No special treatment was given nor was any indicated though Schamberg recommends an ointment consisting of betanaphthol (five per cent) and precipitated sulphur (eight per cent) in benzoinated lard. It is necessary to take the usual precautions to prevent the skin lesions becoming infected.

As regards differential diagnosis reference has already been made to varicella, but scabies and urticaria also require to be differentiated.

The disease is well known in certain parts of America, and according to Walker has been reported in England. Schamberg in America has made a very complete study of the affection, and in Stelwagon's "Diseases of the Skin" will be found references to an extensive bibliography.

Report.

SECOND INTERNATIONAL CONGRESS OF MILITARY MEDICINE AND PHARMACY.

ROME, MAY 28 TO JUNE 2, 1923.

BY ONE OF THE DELEGATES.

WHILE serving, in 1923, at Gibraltar, I was fortunate enough to be selected by the War Office as a delegate to the Second International Congress of Military Medicine and Pharmacy at Rome.

Apparently it was thought by the Powers-that-be that this station was a sort of half-way house to Rome. Certainly all roads lead to Rome; but the other British delegate to the Congress left London on May 25 and arrived at Rome on May 27, whereas I sailed from Gibraltar in the good ship "Kaisar-i-Hind" on May 22 and only arrived in Rome a day in advance of him, i.e., May 26. However, the journey was pleasant and interesting and in no way tedious.

Landing at Marseilles we proceeded by the Riviera express the same afternoon to Nice and put up at the magnificent Hotel Atlantique and had a drive in the evening along the sea front and around the town. The season, so far as British people are concerned, was over, but many French people from inland cities, and other Europeans from central countries were in the town.

Leaving the next morning we had many pleasant glimpses of famous Riviera resorts—Monaco, Hyères, Beaulieu, Monte Carlo, etc.—which previously had been but names to the writer. They all looked lovely in the sunshine and the sea calm and inviting from the dusty train. At Ventimiglio we left the train and crossed the frontier into Italy, where we lunched, in the station restaurant, on Italian soil and started again by train for Genoa. The change from French to Italian Riviera was abrupt—the buildings especially showing lack of attention and obviously lack of money for repairs; etc. It looked as if one had passed from the abodes of the wealthy to the abodes of the poor, and yet the surroundings, the mountains, the flowers and fruits and the sea were the same or even more prodigal in their beauty and luxuriousness.

The trip along the coast is marred here by the fact that every few yards, just as one is having a peep at some lovely scape of land and sea, the train plunges in a moment into a dark and filthy tunnel full of noxious and sulphurous fumes, and windows have to be pulled up only to be lowered again as we rush once more into sunshine and greenery and blue dazzle of sea, to be again plunged into darkness and smoke. I believe it is even more disagreeable at night, when the only thing to do is to close one's window and endure the "frowst."

We arrived at Genoa in the evening. The entrance to the city, through miles of docks and ship-building yards, and the sight of thousands of masts and funnels bringing back recollections of one's native Broomielaw and the Tail of the Bank.

Genoa, where we spent one night, was principally remarkable for its noise; the clash and clang of trams and the shouts and shrieks of people lasting throughout the night. This noise was certainly remarkable to us, but apparently quite normal to the local inhabitants, although I understand that we had arrived at a time of public festivity. We stayed at the Hotel Bristol. This name, as was recently pointed out in the London press, is a common one on the Continent, and personally, I have pleasant recollections of the Bristol at Gibraltar, at Genoa and Albergo Bristol pronounced Breéstol at Rome and again at Naples.

Next morning we were once more on our way to the Imperial City; Saturday, May 26, when we were lucky enough to meet an official of the American Consulate and his wife on the train, and they were able to tell us much of interest. He was on his way to Elba, concerning which historic island the present incumbent held erroneous ideas regarding its geographical position, and obviously, as viewed from the train, there was no reason why the Little Corporal should not have jumped ashore if he wanted to. As we went along we were greeted by a pleasant shower of rain, which is unusual at that time of the year but rendered the journey cool and dustless. A good view was obtained of the Leaning Tower through the rain, and we said farewell to our American friends at Leghorn. The long journey in the evening through the vast plain of the Campagna was

monotonous and yet interesting. All the official houses on the line were proofed against the wily and dangerous Anopheles.

Our first view of Rome from the train was disappointing except for a distant view of the great aqueduct of Claudius—a wonderful engineering feat, but one shudders to think what the water rate must have been in those days, or would be in the present days if water had to be brought to our door by such miles of massive masonry. However, one forgives and understands this expenditure of labour and money when viewing the wonderful fountains of Rome.

Slums everywhere, as we glided into the station, and occasional glimpses of ancient buildings. At the station we were met by that most excellent and energetic of secretaries—Capito Medico Ferri, of the Medical Hospital at Florence, and one of the secretaries to the Congress. To one who had but recently left the stately calm of Whitehall it was rather startling to be greeted with the following behest, couched in the most beautifully pronounced English—"My Colonel, will you report to-morrow at the War Office at 9 o'clock?" One must of course do in Rome as the Romans do and therefore I at once agreed (visions of Whitehall at 9 a.m. on a Sunday morning in May in peace times!) and we set off by taxi to our inevitable "Breestol" through the streets of the Eternal City; occasionally narrow slums with high houses on either hand, again reminiscent of one's native city and the Cowcaddens district thereof, then in a moment into a great square with wonderful palaces and many ancient churches, or perhaps some world-famous ruin such as the Trajan Forum.

I duly reported myself at 9 a.m. at the War Office—a very fine building indeed, but not any more so architecturally than our own War Office. As a matter of fact one was glad to get the business of the day over early, as by noon the weather was uncomfortably hot and uniform was *de rigueur*—indeed one was rather surprised at all times to see Italian officers in thick serge uniforms with black leather gaiters, and some of the northern delegates in even more incongruous kit in view of the almost tropical heat. Our own drill kit was quite welcome in the afternoon.

On one occasion our very good friend the American delegate, Commander Seaman Bainbridge, appeared at one of the meetings in white duck trousers and dark blue monkey jacket, and was greeted by the remark from our friend from Holland: "Ah, you play tennis."

My fellow delegate and I foregathered later on Sunday in the Coliseum, whither we had wandered as the most obvious place to visit in the first instance, and also because it was close to the district Celio where all our meetings were to be held in the Military Hospital.

50 *International Congress of Military Medicine and Pharmacy*

PROGRAMME.

SECOND INTERNATIONAL CONGRESS OF MILITARY MEDICINE AND PHARMACY
UNDER THE EXALTED PATRONAGE OF HIS MAJESTY THE KING OF ITALY,
ROME, May 28 to June 2, 1923.

First Day—Monday, May 28, 1923.

Hour, 9.30 a.m.—Convention in the Capitol for Presentation of Delegates to one another and to General Della Valle, Director-General, Medical Services, Italian Army.

Hour, 10 a.m.—Solemn Inaugural Sitting in the Capitol, Hall of the Senate, the King, the Prime Minister and General Diaz being present. Visit to the Panthéon to place wreaths on the graves of Kings Victor Emanuele II and Umberto I. Visit to the tomb of the Unknown Soldier and placing of a wreath there.

Hour, 4 p.m.—Reception of the official delegates by His Majesty the King in Quirinal Palace.

Hour, 8 p.m.—Official Dinner given by the Committee of Organization to the members of the Permanent Committee and to the official delegates, in the Restaurant of Castello dei Cesari.

Second Day—Tuesday, May 29, 1923.

Hour, 8 a.m.—Ordinary Sitting of the Congress in the Principal Military Hospital at Celio.

Discussion of First Subject: "Evacuation of Sick and Wounded :"
(1) General principles of evacuation in armies in the field ; (2) organization of evacuation as governed by the necessities of therapeutic consideration ; (3) adaptation of medical and surgical treatment to the diverse conditions resulting from the procedure necessary for evacuation.

Speakers (twenty minutes each).

Italy : Major General Medical.

Professor Stefano Santucci.

Major Medical : Cav. Virginio Bernardinis

France : Principal Medical Officer of 1st Class Uzac.

" " " " Dopter.

" " " " Duguet.

(Discussion, five minutes each.)

Hour, 5 p.m.—Reception in the Garden of the Villa Fonseca (Principal Military Hospital, Celio).

Visit to the Military Hospital and Exhibition of Sanitary Materials.



FIG. 1.—Delegates descending the steps of the Capitol after the inaugural ceremony. In front is the French Delegation.



FIG. 2.—Delegates descending the steps of the Capitol after the inaugural ceremony. In front are the Irish Free State and Czecho-Slovakian Delegations.

52 *International Congress of Military Medicine and Pharmacy*

Third Day—Wednesday, May 30, 1923.

Hour, 7.30 a.m.—Ordinary Sitting, Principal Military Hospital (Celio).

Discussion of Second Subject: Collaboration of competent civil and military authorities in matters of hygiene, physical education and of prophylaxis (statistics concerning social maladies, i.e., tuberculosis, venereal disease, alcoholism, mental disease; research into beginning of disease; concerted prophylactic measures, vaccination).

Speakers.

Italy: Lieutenant-Colonel Med. Professor Giovanni Grixoni.

Major Med. Professor Arcangelo de Bernardinis.

England: Colonel D. Harvey.

Major A. Dawson.

America: Commander W. S. Bainbridge, Medical Corps, U.S.A. Navy
(Reserve Force).

Hour, 11 a.m.—Visit to the Policlinic.

Hour, 4 p.m.—Visit to the Roman Forum and to the Palatine under the guidance of the Illustrious Senator Giacomo Boni.

Fourth Day—Thursday, May 31, 1923.

Hour, 7 a.m.—Ordinary Sitting, Military Hospital (Celio).

Discussion of Third Subject: Critical discussion of the processes of disinfection and disinfestation in times of peace and war.

Speakers.

Italy: Lieutenant-Colonel Med. Giuseppe Rizzuti.

Lieutenant-Colonel Professor Ferdinando Martoglio.

Spain: Lieutenant-Colonel Professor José Potous Martinez.

Switzerland: Lieutenant-Colonel Farm. Thomann.

Hour, 9.30 a.m.—Excursion to Anzio.

Departure for Anzio by special train from the terminus station.

Hour, 11 a.m.—Reception by the Town Council of Anzio.

Hour, 11.30 a.m.—Visit to Field Military Climatic Sanatorium.

Hour, 3 p.m.—Departure for Nettuno.

Visit to the School of Malariology of Director-General of Public Health.

Hour, 5 p.m.—Refreshments in the new "Paradise on the Sea." Casino under construction, offered by Cav. Polli.

Hour, 6.10.—Departure for Rome.

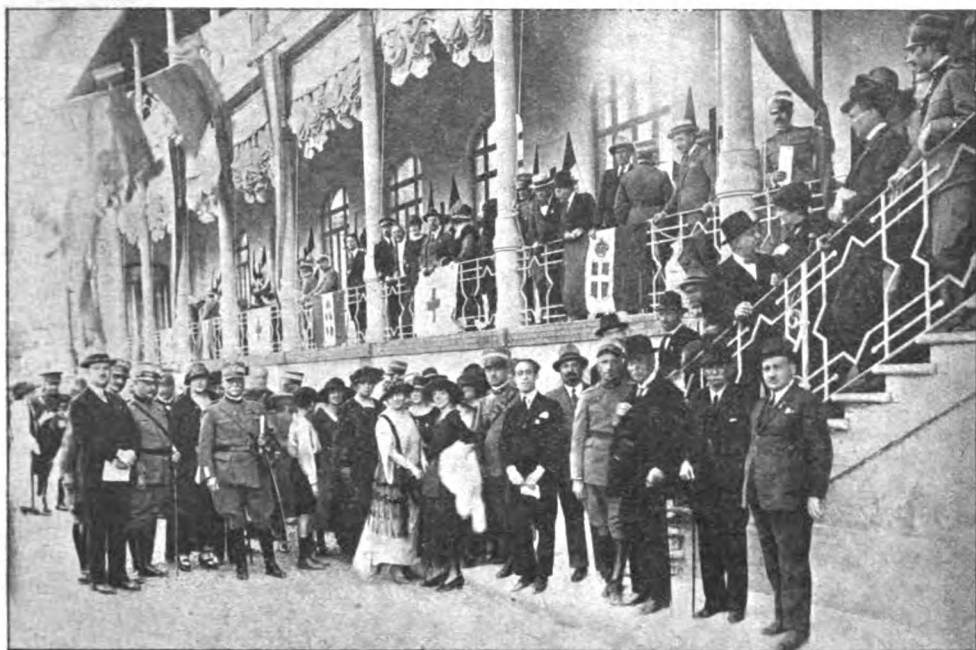


FIG. 3.—Afternoon reception in the Garden of the Villa Fonseca (Principal Military Hospital, Celio).



FIG. 4.—Visit to the Roman Forum and Palatine Hill under the guidance of the Illustrious Senator Giacomo Boni.

54 *International Congress of Military Medicine and Pharmacy*

Fifth Day—Friday, June 1, 1923.

Hour, 8 p.m.—Ordinary Sitting, Military Hospital (Celio).

Discussion of Fourth Subject : Treatment of wounds of the chest and lung, and their sequelæ.

Speakers.

Italy : Lieutenant-Colonel Med. Professor Filippo Caccia.

Lieutenant-Colonel Med. Professor Serafino Ricci.

Jugo Slavia : Colonel Med. Dr. Iched Diourdievich.

Excursion to Ariccia.

Hour, 4 p.m.—Departure for Ariccia in special motor cars (Via Principe Umberto, near the terminus station).

Hour, 5.40 p.m.—Arrival at Ariccia. Visit to Sanatorium for Children predisposed to Tubercle.

Hour, 7 p.m.—Departure for Rome.

Sixth Day, Saturday, June 2, 1923.

Hour, 8 a.m.—Ordinary Sitting, Military Hospital (Celio).

Discussion of fifth subject : Pharmaceutical Theme—Chemical laboratories in the field : their scope and their methods.

Speakers :—

Italy : Lieutenant-Colonel Pharmacist Dr. Alfred Pagniello.

Major Pharmacist Dr. Giuseppe Cappelli.

Czecho-Slovakia : Captain Pharmacist Dr. Bohumil Suchardadott.

General Discussion of Conclusions by the Congress.

Hour, 8 p.m.—Official Banquet to the Delegates and their wives and families.

On Monday morning, as will be gathered from the programme, we entered on a very busy and interesting week, somewhat marred for the writer by the fact that he is unable to grasp Italian even spoken slowly, and quite hopeless when it is spoken at 300 words to the minute, as invariably occurred when one of our gifted Allies really got going ; however, excellent summaries of the papers were available in English and French, so we could grasp the essentials. The general plan was that each nation was allotted a certain subject, and on every subject the Home Team, i.e., Italian, had a speaker ; at the end of the set speeches others joined in the discussion. All those who had spoken formed a sub-committee, which then held meetings in the afternoons and evenings to arrive at conclusions to be submitted to the full meeting of the Congress. Our Sub-Committee were on several occasions entertained to dinner by our friend the American delegate, and also dined with us, and the subsequent discussions went on till the small

hours. It was occasionally disheartening when we thought we had reached a conclusion to find our Italian friends engaged for a solid hour in a heated argument in which it seemed that someone must be injured, and when we inquired in our best French what was the outcome, to be told by our interpreter, a senior Italian naval surgeon: "He say, No." However, by the dint of much patience on the part of all—especially our Secretary, my fellow delegate from England—we finally arrived, as did the other delegates on the various Sub-Committees, at the conclusions which are attached below.

Certainly the most picturesque of the delegates was General Fang, from China, whose full-dress uniform, complete with plumed hat, was the admiration of all; the General looked about 19, but was, I understand, 40 years of age and had several little Fangs; he, besides ourselves and the Americans, delivered his papers in English. It was interesting to find that some of the Italian officers spoke excellent English, which they had learnt during a stay in America, as did also the principal delegate from Czecho-Slovakia.

The most impressive delegation was that of the French, consisting of seven senior officers, including one General, and Professor Dopter, the famous bacteriologist, and headed by Principal Medical Officer of the 1st Class Uzac, a very forceful personality, who was also Chairman of the Permanent Committee on which I served in place of Major Stirling; many inquiries concerning the last named were made by his colleagues from France, Portugal and Spain at the last Congress.

The inaugural ceremony in the Capitol was most impressive, His Majesty the King and General Diaz and President Mussolini all being present; the latter appeared full of fire and nerve and looked as if he might at any time burst into a storm of speech, but he restrained himself.

The official delegates were received by His Majesty the King at 4 o'clock in the Quirinal Palace. We were all drawn up in single file along the two sides and one end of a huge lofty room. The King spoke to each delegate in turn, and was able to do so because he can converse readily in Italian, French or English. He was interested in the organization of our own medical services and asked me many questions, and was obviously familiar with its administration. He also told me something of the work that Italian bacteriologists had carried out during the war in combating cholera and other diseases by detection of carriers; here again he was obviously *au fait* with modern scientific work.

In the evening of Monday an official banquet was given by the Committee to the delegates at the Restaurant Castello dei Cesari, situated on one of the seven hills of Rome. These hills are somewhat disappointing to one accustomed to call mountains hills, as we are at home, but a magnificent view of the lights of Rome was obtained from the glass-walled room where the banquet was spread. After dinner the heads of delegations delivered speeches in various languages, including Scotch and American, and also one

delegate delivered an oration in a mixture of French, Spanish and Italian, winding up with the phrase, "the ladies of Italy I embrace them all"; with appropriate gestures he gave this same sentiment on subsequent occasions and invariably brought down the house. "One touch of nature makes the whole world kind," as the poet has it, or should have it, if he did not.

MENU.

PRANZO AI DELEGATI UFFICIALI ESTERI DELL II CONGRESSO
INTERNAZIONALE DI MEDICINA E FARMACIA MILITARE.

Lista delle Vivande.

Pasta Reale in Brodo Sublime.

Pesce Adriatico Bollito - Salsa Majonese.

Medaglioni di Prosciutto in Bella Vista.

Pollardine Arrosto alla Romana.

Insalata dell'Aventino.

Bomba Napoletana. Dolce dei Cesari.

Frutta di Sicilia. Caffè - Liquori.

Vini:

*Bianco dei Casteli, Chianti Rosso,
Spumante Cinzano Secco.*

*Castello dei Cesari,
Roma, 28 Maggio, 1923.*

(To be continued.)

Travel.

FLOTSAM AND JETSAM.

By COLONEL S. F. CLARK.

Army Medical Service (R.P.).

III

THE great world of our boyhood has become very small now. The fascinating, mysterious blank in the centre of the map of Africa, with its dotted lines marking the possible course of possible rivers, has given place to a complete chart, and the iron horse now runs to time-table where Livingstone and Stanley traversed virgin ground. The white man has been even to the poles and to Thibet, and though this shrinkage of the globe has robbed travel of much of its former glamour, yet it still has a charm, no matter how well beaten the track that we follow may be.

One of the last parts of Africa to be explored was Somaliland, and in the scramble for territory in that continent England, France and Italy each established a sphere of influence there. The British portion begins almost due south of Perim, and extends eastwards for 400 miles, forming the southern border of the Gulf of Aden. It does not reach Cape Guardafui, which the Italians possess, and its depth varies from eighty to

over 200 miles. I was stationed at Aden in 1891-93, and so heard a good deal about this country, and even landed on its shore. The interior is a vast plateau, of a fairly uniform height of about 3,000 feet, and optimists at Aden would at times babble of a future in which they saw sanatoria in these uplands. The rainfall is about eight inches per annum, and this enables a few of the coastal rivers to reach the sea occasionally, but most of them perish in the attempt, from lack of volume.

In my time Somaliland was a big game hunter's paradise, for it seemed to be full of lions, antelopes of all kinds, and other varieties of rifle-fodder, including elephants. Shooting parties used to arrive from England and India, and many officers of the Aden garrison spent leave on the other side of the Gulf, so it is probable that game is scarce by this time. Lions seemed to be as plentiful as rabbits in England, and every now and again a hunter got mauled fatally by one of them. I remember one officer returning with a claw mark on his leg, and scratches on his rifle—souvenirs of an encounter at very close quarters. The Somali shikarris had the reputation of standing by their employers in tight corners like this, and using a spare rifle, muzzle to hide. One young officer had a great story about being pursued by an infuriated elephant, which pulled him off his pony, but lost him by letting him fall into a ditch so full of long, high grass that the angry beast could not locate him to finish him off. The narrator held that his escape was due either to the elephant's trunk being slippery after eating wet grass, or else to his own body being slimy with the profuse perspiration of funk.

Two impecunious subalterns, whose expedition was on an extremely modest scale, had beginners' luck, for their total bag was one oryx, but its horns were of record length.

Intercourse between our nation and Somaliland began about a century ago—through the East India Company and the Government of India. The Khedive of Egypt formerly claimed jurisdiction over the whole coast as far as Cape Guardafui, and in 1874 he garrisoned certain posts in what is now British Somaliland, but ten years later he withdrew his troops on account of the activities of the Mahdi, so England occupied the abandoned coast ports in order to safeguard the approach to the Suez Canal. After that, various Protectorate treaties were signed, and the country was administered by Bombay via Aden up to 1898, when the Foreign Office took it over, but in 1905 it fell to the share of its present administration, the Colonial Office.

Many of us will remember how fighting occurred in 1901-03 between British Forces—mainly natives—and the "Mad Mullah," in which we suffered severe losses, but finally cleared the country and established military posts in the interior, in addition to those on the coast. In 1909, however, the same Mullah appeared again, and began raiding in the interior. The British Government considered that the effort that would be necessary to occupy the whole of the Hinterland effectively was not

worth while, and in 1910 it contented itself by holding the coast by means of the garrisons at Berbera, Bulhar, and Zaila. In my time these places were held by detachments of the Indian Infantry Regiment at Aden.

There are plenty of Somalis in Aden, but nothing will induce them to enter domestic service. They are a race of tall, thin men, with small heads, which are covered with "bobbed" hair of a strong "ginger" shade. This colour is due to the habit of plastering the head with lime, for the purpose, it is said, of killing the fauna that roam in the hair. Their full dress is the "tobe"—a large, white sheet, in which they envelop themselves—and enormous sandals of ox-hide. They usually carry a long thin stick, and are a talkative, quick-tempered, independent race, and fiercely resent any attempt to strike or ill-use them.

A ship of the Royal Indian Marine was always based on Aden, and in October, 1892, I got leave to sail in the "Mayo" on one of her periodical trips round the neighbourhood. The only other passengers were the Port officer and his wife who were having a holiday cruise like myself, and an artillery subaltern who was after big game. A night's run of 150 miles, due south, brought us to Berbera—the capital of British Somaliland—which possessed a lighthouse and several large buildings. The subaltern landed at once, but the other three of us waited for the cool of the evening, when the Port officer—a sailor—sailed us ashore in one of the ship's boats on a "soldier's wind." It seems that this is the name given to a breeze blowing at right angles to one's course, so that it is just as easy to sail back again as to get there. The sailor has such a contempt for a soldier at sea that he has uttered his last word in regard to ease of seamanship when he considers that even a soldier could manage a boat in a breeze like that. There is no lower depth of comparison to be plumbed.

We saw the British representative, who told us a thing that was gratifying to our national pride. He said that when a Britisher went on a shooting expedition into the interior, he left a sum of money at Berbera in charge of the speaker, and the Somalis whom the sportsman hired were quite ready to be paid by cheques on Berbera, even if they were discharged miles away; but all foreigners had to produce hard cash in payment of their followers.

We soon wandered out of the town and found some nomadic natives who kept ostriches, and who followed the meagre rains in search of food for their stock. They lived in small, bee-hived-shaped wigwams, which were made of grass mats spread on a wooden framework, and were very portable. A white woman was evidently a rarity in these parts, for the Port officer's wife caused a great furore among these wandering people, and was stared at and mobbed like Royalty in our own land.

The Somalis are said to agree with the character in the play, the "Mikado," who held that feminine beauty should not be judged by the face only, and who draw attention to the attractiveness of her left elbow;

for they are credited with appraising the comeliness of their maidens in direct ratio with the protuberance of their gluteal muscles.

We sailed at sunset, and about noon next day arrived at Perim—the well-known island at the southern end of the Red Sea. I suppose everybody in the Service knows the yarns about how we are said to have forestalled the French in the occupation of this place, and how an O.C. troops at Perim once signed innumerable blank forms and returns, and then went off to England on his own, while his faithful clerk completed the documents and sent them in as required.

If the first of these stories is true, the incident happened in 1857, when we annexed the island, but British troops occupied it in 1799-1801, on account of the presence of the French in Egypt.

Our ship entered the very good harbour on the south side of the island, and we were amused to see great stacks of coal at undefended Perim, as we knew that there was very little of this commodity at Aden, with its strong forts and its substantial garrison. It had been brought thousands of miles to a place where it would have to be set on fire to save it from capture, when another ninety-six miles would have given it the security of Aden. Still, in times of peace, the geographical position of Perim is undeniably more convenient for the coaling of mercantile ships than that of Aden.

We went on shore and noticed that there was plenty of coral about, and soon found that the going in the interior was very rough, over large rocks and stones. We visited two lighthouses and the quarters of the solitary British officer who commanded the fifty men of the native infantry detachment who formed the garrison. He was all packed up in hopes of getting leave home, and was evidently a high-class optimist, for a year afterwards I heard that he was still packed up, still waiting to get to England.

Early next morning we sailed for Zaila, a post near to the boundary of French Somaliland, and after a ten hours' run, and having passed many shoals and coral reefs, cast anchor there a long way from the shore. We landed and were interested to note that the houses were built of large, squared blocks of coral, and that the military detachment lived in a strong zareba. Here we took on board Captain Swayne and his brother, who spent the years from 1886 to 1892 making surveys of the country. They were credited with knowing more about Somaliland than anybody else, and one of them afterwards commanded the troops in the 1901-03 fighting, and was also at one time British Commissioner in the Protectorate. These two men could tell many a quaint story, and our ship returned to Berbera to land them there. We did not visit Bulhar, the third of our occupied ports on this coast, but it has only an open anchorage for shipping. We put our distinguished passengers ashore and then headed for Aden, which we reached at 7 a.m. on the 7th inst. I got into harness again at once, for I spent the next twenty-four hours in attendance on a case in the Staff Quarters.

IV.

It cannot be a common occurrence for officers travelling on duty to find themselves at Jeddah, shipmates with pilgrims for Mecca, but I had this unusual experience in 1903. In that year I was tour-expired in Hong-Kong, and was directed to return to England in the Blue Funnel ship "Antenor," in charge of an officer and two men who were, shall we say, eccentric. The mail steamers refused to have them, but the cargo boat was not so particular, and the arrangement suited me as it meant a free passage for my wife and young son. We had a deck cabin forward, the invalid officer had one nearer the stern, while the two men and the conducting party were accommodated mostly up the forecabin way. They were a motley collection of all ranks and arms of the service, ranging from an artillery serjeant-major to a gunner who was being sent home for discharge as worthless and incorrigible—the result of an unslakable thirst. As this man arrived on the ship in a penniless condition, he gave no trouble until the last lap of the voyage, while the others were decent, steady, time-expired N.C.O.s and men, and included an R.A.M.C. corporal as special attendant on the officer.

After glancing at the cabin we did a hurried re-pack on the deck, to reduce the number of packages to go into it—an operation which I had foreseen long before—and on January 21 we steamed off for Singapore, which was duly reached without any "fire or other unusual occurrence" happening. We stayed there for nearly a week, taking in tobacco, and one of my batch kindly insisted on putting us up in his bungalow. This was the one station in the world that I had always dreaded, and my luck was in when I probably just missed it for Hong-Kong. I found it laid down in King's Regulations that the Officer Commanding troops on a ship must report himself at all garrisons touched at, so it was with a subdued feeling of importance that I presented myself at Headquarters and was received by the General Officer Commanding. The only visible result was the appearance of a "red cap" at the wharf that evening.

After all the tobacco was on board, most of the remaining space was filled with Moslems of both sexes who were bound for Mecca. Some of the women were of the veiled class, and they vanished at once somewhere into the bowels of the ship, and were seen no more until they emerged at Jeddah. The remainder bivouacked about the decks and were a never-ending source of interest to us. Many had brought coops of chickens with them for food, and before decapitation it was their custom to pluck all the feathers off an inch or so of the neck of the doomed bird to give the knife free play. It reminded us of the toilette for the guillotine that one reads of. One day a prepared victim got away, and ran along the top of the awnings pursued by a young native armed with a blade quite eighteen inches long. When it saw that escape was hopeless, the intelligent bird scored off

its owners by plunging into the sea and so depriving them of the meal, which was doubtless partaken of by a shark instead.

Our next port was Penang and, as this was my birthplace, I was naturally intensely interested in seeking out the house that I was born in and places that I remembered. We stayed here for two days, but malaria kept me on board the second day, on which the number of our pilgrims—170—was completed.

We were the last pilgrim ship of the season, and there was a prolonged counting of heads by shore officials, who finally declared that there was one passenger in excess of the number allowed to be carried. A luckless oldish individual was fixed upon as the odd man out, and he was ordered on shore, but as he refused to go the boatswain lifted him up, bore him down the gangway ladder, threw him bodily into a handy native boat, and shied his luggage after him. The man then burst into tears, and anybody who can realize his feelings will sympathize with him. The journey to Mecca had doubtless been the lode star of his life for many years, during which he had scraped and saved to pay the cost, and we can imagine his feeling of exultation when he found himself actually on board the ship that was going to that portal of paradise. How his heart must have broken then, when he was ignominiously flung back into a cold world, with his castles in the air falling around him in ruins.

We steamed from here without a stop until we cast anchor at Jeddah, and it was a mystery to me why a fine ship with a valuable cargo was sent to such a hair-raising place. As we approached the land coral reefs appeared everywhere. They lay in rows like long walls parallel with the shore, as far as the eye could reach, with several wrecks upon them, while other reefs were scattered about all over the place, some of them above the water and some a few feet below it. What struck me as curious and opposed to one's preconceived ideas, was the fact that the water over the submerged reefs was not white but looked muddy. There was a fearsome collection of these muddy-looking patches all around, great and small, and I got a bad shock when the captain showed me the chart of the way in, especially as it indicated one reef, apparently right in the channel, which was named after a sister ship that had once struck it. At this moment the fact that my baggage was not insured caused me an acute feeling of remorse, and since then I have never gone to sea with unprotected effects.

A small Turkish war ship was anchored between the shore and the main reef wall, and we were told that she had lain there so long without ever raising her anchor, that the reefs now enclosed her completely and shut her off from ever getting to the open again. As everything movable on board had probably been sold by the captain, and as some pay for all hands, including the dead, doubtless came along occasionally, and as no questions were ever asked concerning cruises, gun practice, or awkward things like that, it is quite probable that contentment reigned on board.

Just when I was wondering if it was time to look up some life-belts, a boat reached us, and an Arab therein announced himself as the pilot. As

we had come from plague-infected Hong-Kong, the local port orders forbade him, or anybody else, to come on board, but, as soon as the boat was made fast, our new friend slipped up and made his way to the bridge. His boat had a good mast, and to hoodwink any watchers on shore, one of its crew took up his position at the masthead and pretended to be conning the ship from there. When we got as close in as the real pilot dared to go without fear of detection, he returned to his boat by a devious route, taking cover as much as possible behind ventilators, passengers, etc., and then relieved his double at the top of the mast and carried on his duties. We presently cast anchor and transferred our pilgrims to shore boats which came out to receive them. The veiled women emerged from their seclusion, and an astonishing amount of luggage was put out. Several large trunks seemed to be full of water—presumably for the overland journey which now faced the pilgrims—but they leaked woefully in the slings of the derricks: in fact the water streamed out of them, so that they very soon must have been as dry as America is alleged to be.

My recollections of Jeddah are dim, as I took no notes, but it seems to me to have looked like any other Eastern port—buildings along the shore, mosques, sand and glare. It was a race between us and the sun as to who got out first, but with the help of the pilot we cleared all the dangers—including a submerged rock whose exact locality was said to be uncertain—just before darkness fell. I suppose it was easy to the pilot, but how our big ship got out of that circle of reefs has ever been a marvel to me.

Our next stop was at Suez, where we lay well away from the shore while a disinfecting lighter came alongside and fumigated all the crew and their effects. The passengers, my lot, were lined up, and had their pulses felt by a French doctor—suppressed amusement being apparent when he took hold of the invalids, but they did not give themselves away. No chance of going ashore here or at Port Said, where we coaled, and then we were off for our next port, Amsterdam.

Although our ship was in every respect a British one, she was on the Dutch register and flew Dutch colours—for reasons apparent to shipping people—and our cargo of tobacco was consigned to Holland. Off the coast of Portugal and in the Bay of Biscay we encountered as severe a gale as I ever care to meet on the waters. The seas were tremendous, and to a landsman appeared to be genuinely "mountains high," with abyssmal troughs between the waves. Our upper deck cabin had one of the trumpet-mouthed nautical ventilators on its roof, hardly below the level of the bridge, and on one night of the gale a rush of sea water came down it and flooded the cabin over a foot deep. I had to get up, rescue all the boots, etc., that were floating about and bale the water out. We were driven off our course towards France and passed one or two great liners outward bound that were clawing their way out to escape destruction on the northern coast of Spain.

The gale eventually blew itself out, and we reached Ymuiden safely,

where we found a ship canal cut right through to Amsterdam on the Zuyder Zee. We passed right along it and spent a week at the last-named city, unloading our cargo. As the Boer war had not been long over, I thought it would be interesting to both the citizens of Amsterdam and to ourselves to take my men for a walk through the town in uniform, but the captain did not encourage the idea, so those who had mufti used it, and the sailors rigged out those who hadn't any. It was difficult to get into the picture galleries as my son was always too young to be admitted, and though I raised his age by a couple of years successively at each one as I tumbled to the game, it was of no use as the doorkeepers did the same thing in regard to the minimum age necessary to gain entrance.

The only one of the escort to whom I refused shore leave was the worthless and incorrigible gunner, but as our ship lay alongside the wharf for her whole length he slipped off by night by some channel other than the gangway, in clothes borrowed from one of the crew. He had made some money on the voyage by doing washing and meant to give his chronic thirst a treat for as long as his coin lasted. I did not bother about him until it was getting time for our departure, when I talked of going to the British Consul to get him to obtain the good offices of the police to find my man, but the R.A.M.C. corporal said that he knew where he was, so he was told to go and fetch him. Next morning my friend was in his bunk as if he had never left it, but his earnings had gone to the last penny and he looked very washed out. I had him up at orderly room but was puzzled how to punish him. A fine could not be collected, he had no pay to be stopped, cells or confinement to barracks were out of the question, so I told him that, as his absence had put extra duty on better men than himself, he must be on practically permanent sentry duty over the invalids until we reached England, but he thereupon spiked my guns by informing me that he had already arranged to do this. I felt that there was no more to be said.

We had a fog in the Channel, missed the tide at Gravesend, where I handed over the officer, disembarked everybody else at Tilbury on March 12, and took the other two invalids to Netley, where I was hospitably entertained and put up for the night.

Fifteen years afterwards the officer I had landed and myself appeared before the same medical board. He did not seem to recognize me and I said nothing to him, but the odds against such a meeting taking place must be long ones.

Current Literature—Medicine.

The Therapeutic Use and Toxicity of Picric Acid: With a Report of Two Toxic Cases. By G. T. Pack, M.D. (*Journal of Industrial Hygiene*, iv, No. 12, April, 1923).—The use of picric acid internally for trichinosis and malaria was formerly practised, but is devoid of any merit. Although it possesses vermicidal capabilities, its toxicity when given *per os* contra-indicates its use for this purpose. It is used mainly for local application to burns of the first and second degree, and has been recommended in a number of skin infections, as well as for dressing superficial wounds and ulcers when free of discharge. The phenol coefficient of picric acid is six, so that a solution 0.165 per cent is equivalent in antiseptic strength to a one per cent solution of phenol. Ehrenfried describes its local action as follows:—

“Over any clean denuded surface it forms a protective, aseptic scab, by coagulation of the secreted serum, which seals up ruptured lymph-spaces, protects exposed nerve-endings, and splints the wound in such a fashion that epithelial proliferation may proceed rapidly beneath, simulating Nature's method. This artificial scab protects against infection from external sources and promotes rapid and painless epidermatization.”

The physiological dose of picric acid is half a grain, and doses of fifteen to thirty grains are decidedly toxic. It forms a 1.2 per cent solution with water, while in alcohol its solubility is six and a half times as great, and its absorption rate is moreover much increased. Out of over one hundred cases treated by the author toxic symptoms were only seen in two, and in these it was found that a saturated solution in ten per cent alcohol had been inadvertently used in place of the aqueous solution used in all the other cases.

The Sequelæ of Epidemic Encephalitis in Childhood with Notes on the Prognosis as regards Complete Recovery. By Grace H. Anderson (*Quarterly Journal of Medicine*, No. 63, April, 1923).—From a study of forty cases of encephalitis lethargica in childhood the author has come to regard disturbance of sleep sequence, psychical changes, and the development of troublesome habits as the most frequent sequelæ. Chorea, when present, almost invariably developed during the acute or primary stage of the disease, but tended to recur in combination with the various sequelæ for long periods after apparent recovery. Other forms of motor unrest were not encountered in this series of cases and no instance of the myoclonic type of spasm was observed. Paralysis of cranial nerves was not uncommon during the acute illness, but never recurred, and in all the cases tended either to improve or remain stationary. Typical Parkinsonian tremor developed in only one case, but a mask-like expression, in some cases accompanied by slow scanning speech, without other symptoms of paralysis agitans, was of frequent occurrence.

Disturbance of sleep sequence occurred in twenty-six of the thirty-three non-fatal cases, and persisted for periods of from four months to four years. The large majority of the children suffered from the disturbance for at least two years, and in many instances were the subjects of psychical changes or mental impairment at the end of that time. The prognosis is therefore bad. The author has not been able to conclude that either age, sex, year of onset, or severity and duration of the initial illness have any effect on the severity or duration of this after-effect. Treatment is unsatisfactory, the usual soporifics in ordinary doses having little effect on the condition. Temporary benefit has been obtained by complete change of surroundings and quiet, by hypodermic injections of milk which cause a rise in temperature, and by subcutaneous injections of sterile water.

Psychical disturbances developed in twenty-five of the patients, and consisted usually in a complete change of disposition, of which the main characteristics were disobedience, excessive irritability, and unprovoked fits of temper, cruelty to relatives and to animals, destructiveness, emotionalism, and, more rarely, kleptomania. The change in disposition was seldom accompanied by any marked degree of mental impairment. Definite mental impairment ensued in ten of the children, all of whom showed a striking freedom from the psychical disturbances characteristic of the badly-behaved group. Only one child has recovered from the psychical change at the time of writing, but several who have been admitted to institutions are beginning to show signs of improvement after two years.

As in the case of sleep disturbance, no connexion can be demonstrated between the sex, the year of onset, or the severity of the initial illness, and the severity or duration of the psychical changes. It would seem from the cases described, however, that the younger children show a greater tendency to become mentally impaired and the older children to develop changes in disposition. The only treatment which appears to have had any effect on the condition is careful training and supervision in an institution for defective children.

Of the troublesome habits which developed as a result of encephalitis lethargica, spitting and hysterical or hyperpnoeic breathing were undoubtedly the most frequently encountered. Other habits of a more or less distressing nature have been observed, but not with sufficient frequency to deserve special attention. None of the children suffering from habit peculiarities has recovered, though some have been under observation for over two years, and no treatment is known to affect the condition.

Diagnosis of Plague by Liver Puncture: Its Prophylactic Importance. By Bouffard and Girard. (*Bull. Soc. Path. Exot.*, xvi, 7, July 11, 1923).—The early bacteriological diagnosis of plague particularly in the absence of bubonic manifestations presents considerable difficulty, especially among natives, on account of the difficulty of obtaining material for post-mortem examination, difficulty of isolating

organisms from blood taken from the living subjects and the frequent absence of murine plague. The authors therefore adopted the method of liver puncture followed by examination of a direct smear made from the material thus obtained. A needle, seven centimetres long, of the size commonly used for lumbar puncture is inserted two fingers' breadth below the right nipple, one centimetre to the right or left of the nipple line. These points are generally situated in the fifth intercostal space. The needle is inserted vertically to a depth of four or five centimetres and suction applied by the syringe. Usually, no material is drawn into the syringe, but the needle will contain sufficient to be expelled on to a slide to make a smear. Great care is necessary in expelling the material to avoid scattering drops of the highly infectious material being dealt with. The smears are stained by Gram's method. The smear will contain a quantity of liver cells, and at the edges will be found clear zones where the plague bacilli can usually be easily found.

Experience acquired in 3,500 examinations carried out in this manner on living and dead subjects has convinced the authors of the great value of this method. They state that no confusion can arise between the bacilli of plague and other organisms, that a positive diagnosis leaves no room for doubt that the number of positive cases which fail to be revealed by this method is very much smaller than by any other method, and finally, that the rapidity with which the examination can be carried out is a point of the utmost importance.

Weight and Longevity.—The *Statistical Bulletin* of the New York Insurance Company, November, 1922, draws attention to the relation which exists between the weight of the body and length of life.

Experience has shown that excessive weight constitutes an imperfection which is especially prejudicial after 35 years of age, and that this imperfection increases with time.

Men below five feet eleven inches in height who increase twenty per cent in weight between 30 and 40 years of age, incur a proportionate increase in death risk, amounting to thirty per cent. If the increase in weight is thirty per cent the risk increases enormously and may exceed the normal rate by eighty per cent.

In people who are over six feet three inches in height an increase of twenty per cent means a mortality exceeding the average by forty per cent.

Weight below the normal, although it may cause inconvenience and may even be a danger to young people, becomes on the other hand an advantage as life proceeds and in old age constitutes one of the principal factors of longevity.

Studies have moreover been made of the relation of weight to diseases of the heart, kidneys, lungs, etc., as well as deterioration of the arteries.

Diet standards have been drawn up with a view to assist the individual to avoid the accumulation in his tissues of an excess of fat which is liable to compromise his vitality.

A Note on the Reliability of Post-Treatment Diagnoses of Helminth Infections. By K. S. Mhaskan. (*Ind. Journ. of Med. Res.*, 11, January 3, 1924, p. 743).—This paper is intended to show the period that must be allowed to elapse if a reliable diagnosis of freedom from helminth infections is to be made after treatment. Betanaphthol, thymol, carbon tetrachloride, oil of chenopodium, were each given to a batch of fifty convicts and santonin to a batch of twenty. The stools passed during the fifteen days which followed were examined for ova by the flotation method, two such examinations being made for each stool. The results showed that betanaphthol, thymol, carbon tetrachloride and santonin have a fleeting toxic effect lasting for three days on the ovulation of hook worms and round worms, so that a diagnosis as to the efficiency of cure is impossible for the first three days. After this, the examinations were either consistently positive or negative. Oil of chenopodium is more toxic to these worms and its effect is evident up to the twelfth day of treatment, before which it is impossible to be certain of a cure. None of these drugs in the dosages employed were toxic to whip worms.

The Prophylactic Injection of Normal Serum as a Preventive Measure against Measles. By G. Salomon (Berlin) (*Deutsch. mediz. Woch.*, August 31, 1923, p. 1151).—It has been affirmed that the serum of patients convalescent from measles possesses the property of preserving healthy subjects against this disease. Having a vast field of observations and not enough convalescent serum, the author decided to use the serum of adults in the same manner.

The 198 infants on whom observations had been made were divided into three groups: (1) Those treated by the serum of convalescents (62 cases); (2) those treated by the serum of adults (76 cases); and (3) those non-treated (60 cases).

The results recorded at the end of this experiment are not without a certain interest. All those who were not preventively injected, contracted measles (100 per cent). Of those who were injected with the serum of convalescents, more than one half (59·7 per cent) remained free from attack. Also, nearly one half (47·36 per cent) of those treated preventively by the serum of adults have not taken the disease.

If we consider, besides, the rate of mortality, the frequency of complications and the course of the disease, we must arrive at this conclusion, that the two sorts of serum are of an approximately equal value. Perhaps it might be well to add that the adults from whom the serum was taken had previously had measles.

Inoculation Treatment of Typhoid and Paratyphoid Fevers. Valdemar Bie (*Acta Medica Scandinavica*, lx, Nos. 2 and 3, March 19, 1924, p. 119).—Each cubic centimetre of vaccine contains 1,000 millions of typhoid bacilli killed by a solution of 0·5 per cent phenol in physiological salt solution.

In thirteen cases of typhoid and six cases of paratyphoid this typhoid vaccine was injected into the muscle for five successive days in increasing doses of 100, 200, 400, 700, 1,000 millions of bacilli. The treatment was only begun after confirmation of the diagnosis, either by sero-reaction or by the cultivation of bacteria either of the blood or of faecal matter.

One of the typhoid patients died as a result of pneumonia; in another, the treatment produced no effect. The result was favourable in the seventeen remaining cases, decrease of temperature by lysis beginning at the close of the treatment, or during the days following. This result was obtained independently of the stage of the disease at which the injections were made, these having been completed between the thirteenth and fortieth days of the illness. The condition of the patient continued to improve during the time of defervescence.

The treatment must be regarded as a non-specific protein therapy. No complications resulted.

Convalescent Serum in the Treatment of Erysipelas. H. P. P. Jordan and C. C. Dustin (*Journ. Amer. Med. Assoc.*, lxxxii, No. 11, March 15, 1924, p. 874).—Convalescent erysipelas serum is sterile serum from the blood of patients convalescing from uncomplicated erysipelas. Patients who have had a normal temperature for at least a week and who show practically complete clinical recovery without complications are chosen. Only patients with negative blood Wassermann reactions have been selected. The blood is allowed to stand in the ice-box for from thirty-six to forty-eight hours, after which the serum can be poured or pipetted off without the admixture of many red cells. The serum is centrifugalized at high speed and then transferred to sterile ampules and sealed. No preservative is added. The sealed ampules are heated at 55° C. for one hour on three consecutive days. Serum prepared in this way has been kept in the ice-box for months without losing its potency. The serum has been used in eighteen cases, sixteen of which were severe infections; practically all the serum was given intramuscularly. The maximum dose has been 40 cubic centimetres, the minimum 10 cubic centimetres, and the average 14.5 cubic centimetres. As a rule only one dose of serum was given. Of the eighteen cases, three which were moribund on admission died, two showed questionable improvement and thirteen showed very decided improvement. The authors express the opinion that the improvement was unquestionably due to the use of the convalescent serum.

The Incidence of Rheumatic Diseases. Public Health Reports No. 23. *Summary.*—(1) Material produced from records of 91,000 insured persons of both sexes in all types of panel practices (seventy-five practices), which gives a reasonably fair estimate of the relative proportions of rheumatic diseases in the year 1922, and enables approximate attack rates for age groups of insured workers to be prepared. The inquiry necessitated a

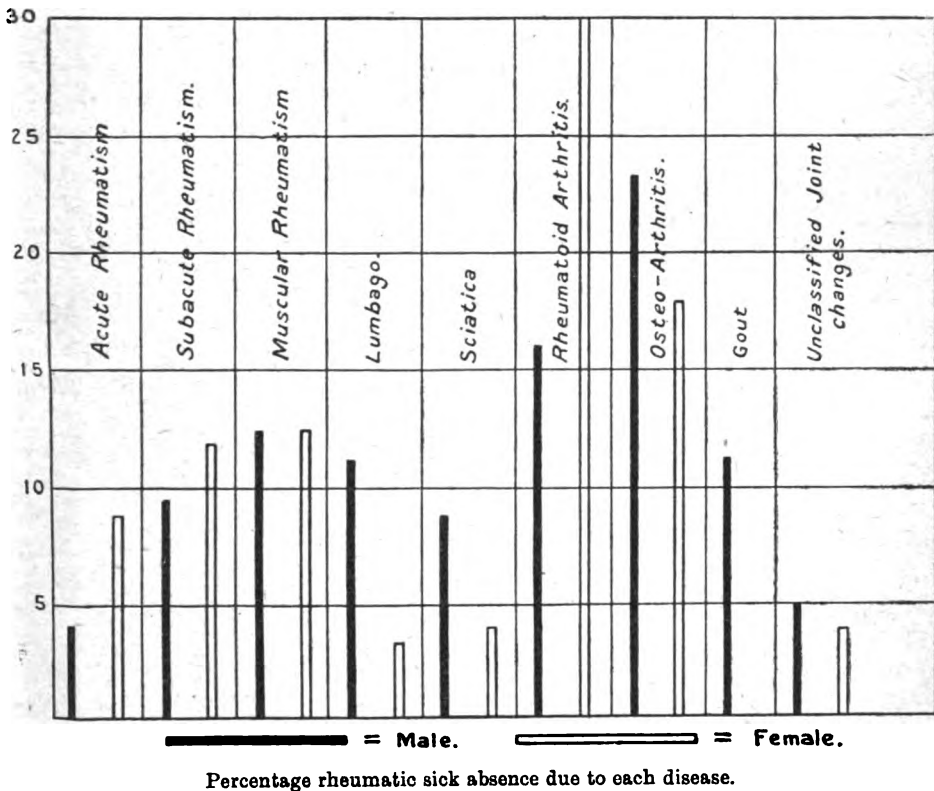
definite classification of the diseases, more particularly owing to the very unsatisfactory and varied classification in use in all countries. The following classification was adopted, which does not however include cardiac cases as such, or forms of arthritis due to specific causes such as gonorrhœa.

(a) Acute rheumatism (rheumatic fever) together with sub-acute rheumatism.

(b) Non-articular manifestations of so-called rheumatism.

(c) Diseases characterized by chronic joint changes.

Inquiry forms, showing the lines of investigation, were issued and record cards for actual cases; the latter containing a comprehensive record



of ætiological and clinical findings, together with a detailed set of instructions.

The size of the sample population was 1/149 or 0.69 per cent of the whole insured population or 1/139 or 0.72 per cent of persons actually on panel lists.

The age distribution, environment and occupational distribution can only be approximately gauged. Geographical classification was by arbitrary divisions.

Findings.—It was found that practically one-sixth of industrial invalidity was due to these diseases. Women workers showed most liability to acute rheumatism, rheumatoid arthritis (three times males) and osteoarthritis (an unexpected result). Men showed predilection for sciatica (four times women), lumbago and gout. The last has remarkably small incidence; greatest in Birmingham and least in Norwich areas.

The age grouping of women was of the lower age groups and favoured the more acute conditions, namely rheumatic fever. Nearly half the cases of this type showed evidence of endocarditis, recent or old; but account has not been taken of these conditions as a cause of invalidity.

Causation.—Tonsillar sepsis was found in fifty per cent of cases of acute rheumatism and only two per cent of cases of class (a) gave a history of previous removal of tonsils.

Dental sepsis is so common amongst the classes concerned that no definite conclusions can be drawn; but it was found that seventy-five per cent of all cases over 25 years of age showed definite dental sepsis.

Previous attacks of acute rheumatism and cardiac infection appeared to have a definite relation, and emphasize the need for adequate convalescent treatment of such cases in special recovery homes.

Dampness appears with overcrowding to play a pronounced part in the classes (a) and (b).

Chill combined with dental sepsis appears to be the chief ætiological factor in all non-articular types, and attention is drawn to the benefit of drying rooms instituted by some works and collieries.

From 91,000 persons 2,510 cases of rheumatism were recorded—a general attack rate of 27·6 (30·5 per 1,000 insured males and 22·5 per 1,000 females).

From the proportionate figures for the separate conditions, the following may be estimated for England and Wales: 56,000 cases of muscular rheumatism; 90,000 cases of lumbago; 27,000 cases of sciatica and brachial neuritis. And in addition 52,000 non-articular “rheumatic” cases amongst insured women.

Assuming the sample is a fair one of the general insured population (actually there was an excess of industrial workers compared with rural workers), the above represents a cost of about £2,000,000 and a loss of some 3,140,000 weeks of work.

Of this vast mass of invalidity between one-third to one-half has a definite focus of septic infection, which could be and should be preventable. The year 1922 commenced with a sharp epidemic of influenza but subsequently the record showed one of the healthiest years ever known in England: hence these figures acquire a still greater significance.

These figures indicate the urgent need for improvement in school hygiene and attention to teeth and tonsils of school children, for improved housing conditions, and for better methods of treatment of early cases of rheumatic conditions.

Reviews.

HISTORY OF THE GREAT WAR. MEDICAL SERVICES. GENERAL HISTORY.
Vol. III. THE MEDICAL SERVICES DURING THE OPERATIONS ON THE
WESTERN FRONT IN 1916, 1917 AND 1918; IN ITALY, EGYPT AND
PALESTINE. By Major-General Sir W. G. Macpherson, K.C.M.G., C.B.,
 F.R.S., L.L.D. Obtainable through any bookseller or directly from
 His Majesty's Stationery Office, Imperial House, Kingsway, London,
 W.C.2. 1924. Price £1 1s.

The Medical History of the Great War on the Western Front is completed in this volume, and the campaigns in Italy, Egypt and Palestine are described.

The preface states that limitations of time and space have been imposed upon the historian, but we hope that a description of the medical services in Gallipoli, Salonika and German East Africa may yet be published. The corps is deeply indebted to General Sir W. G. Macpherson for these works of which the educational value is exceptionally great.

The sketch maps, charts and diagrams are excellent, and the carefully compiled appendices will repay close study.

Chapters I to XVIII cover the Western Front operations from February, 1916, to the end of December, 1918, and account for three-quarters of the book.

The Somme battles are fully described, but the advance to victory has had to be somewhat compressed. This is unfortunate as much could have been learned of the tactical handling of medical units in a rapid advance, from a more detailed account.

Chapters XVIII to XXII deal with the medical services of our forces in Italy, Egypt and Palestine.

The actions of the Bluff; St. Eloi Craters; the German attack on the Vimy Ridge; the battle of Mount Sorrel and the engagement at Fromelle are described in Chapter I. The succeeding forty-three pages forming Chapter II describe the medical arrangements for the battle of the Somme. Fifty-six infantry and six cavalry divisions took part at different periods in this stupendous struggle which lasted nearly five months. The main part of the fighting fell to the 4th Army which had five corps on a front of about twelve miles. A study of Appendix "B" together with page 50 enables the arduous work of the medical services to be appreciated; 310,073 wounded were admitted to field ambulances, of whom 304,285 were subsequently evacuated to the base from casualty clearing stations. In addition some thousands of sick cases had to be provided for.

That 26,675 wounded could be collected by field ambulances in the first twenty-four hours of a battle would have been considered impossible in 1914. The price paid in casualties among the medical services is shown on p. 53.

The lessons contained in these pages are chiefly:—

(1) The rapidity with which casualties reach the clearing stations in the first twenty-four hours of a modern battle necessitates an accurate and timely appreciation of ambulance train requirements in order to avoid congestion of the wounded.

This point is well brought out in a memorandum of the Director General, Medical Services, on p. 47.

(2) The constant changes of divisions justify the temporary detachment of sanitary sections for area work in order that a continuity of sanitary efficiency of a high standard may be maintained.

(3) The need for the allotment of clearing stations for treatment of special cases, sick, etc.

(4) The general scheme of the medical arrangements evolved as the result of previous experience in the tactical handling of field ambulances and the strategical grouping of casualty clearing stations proved adequate even when subjected to such a severe test.

Chapter III describes the advance to the Hindenburg line in 1917. The chief anxiety at this time, from the medical point of view, was to ensure an adequate number of vacant hospital beds for reception of the estimated battle casualties.

Lack of available medical personnel rendered the formation of new hospitals impossible, but 36,000 beds were provided by increased evacuation of patients to England. In these operations collection and removal of casualties from the forward area was rendered more difficult owing to the destruction of roads and bridges by the retreating enemy.

The medical arrangements for the battle of Arras 1917 are contained in Chapter IV. The pooling of the divisional ambulance cars with the motor ambulance convoys is described on pp. 77 and 78, and the special orders for the clerical work at casualty clearing stations on p. 79.

These innovations did not fulfil expectations as the later stages of the battle clearly proved.

The cavalry advance to Monchy-le-Preux is of great interest as it records the medical arrangements for a mounted force in an advance. The Assistant Director of Medical Services of the Cavalry Division had taken over immediate control of his field ambulances except the pack mounted sections which were commanded by the field ambulance commanders in person. These sections failed in their function and it would appear that their value is doubtful. There was loss of close touch between regimental medical officers and field ambulances which caused confusion and regrettable delay in the evacuation of casualties.

The next chapter gives the medical arrangements for the battle of Vimy Ridge which worked smoothly and well.

Chapter VI outlines the Flanders offensives in 1917 in which mustard gas was first used by the enemy. Special arrangements to deal with this were introduced in forward areas and at casualty clearing stations. The

surgical cleansing of wounds before evacuation became the rule, and the 5th Army adopted the principle of retaining for treatment so called shell-shock cases in a specially organized casualty clearing station sited in an advanced position as possible.

The next chapter describes the medical arrangements for the battle of Messines which worked well. The spheres of responsibility were clearly defined, and trench tramways were fully utilized from regimental aid posts to advanced dressing stations. A good specimen of corps medical orders is given on pp. 125-6-7.

The first instance of the formation of an advanced convalescent depot for 1,000 patients likely to be fit for duty in four to five days, occurs in the preparations for this battle.

The diagram facing page 134 is worthy of close attention as it outlines the evacuation from the line to casualty clearing station. Chapter VIII is the story of the battle of Ypres, 1917, which lasted nearly four months and resembled the Somme battles, in that various divisions were engaged at different times. The attack on November 6 was made by the 3rd and 4th Canadian Divisions with the 1st British Division. The Somme Redoubt Advanced Dressing Station was shared by a Canadian and British division.

The hand-carry of 5,000 yards to this advanced dressing station was a severe strain on the field ambulance bearers. The tracks were over shell-pitted ground which the rains had turned into a quagmire. Enemy shelling and bombing of medical units during these battles were specially noticeable. The siting of casualty clearing stations too far forward was brought to notice by the Director General, Medical Services. The medical arrangements of the 5th Army were voluminous and contained much detail. Many returns were demanded from divisional assistant directors of medical services, who were often only a few days in the same corps. High-explosive shell wounds predominated among the 10,789 wounded evacuated. Sick cases were in the proportion of 1 to 2·3 wounded among officers, and 1 to 2·46 wounded among other ranks.

Chapter IX gives a brief account of the battle of Hill 70, while in Chapter X the Dunkirk Nieuport area is described. The sketch opposite page 177 was apparently drawn after July 10, as previously two regimental aid posts in the support trench across the Yser of the Left Sector provided medical aid for the two battalions holding the line. Oost Dunkerke Bains was the headquarters of a field ambulance and had considerable accommodation for casualties. The advanced dressing station of this sector in Nieuport Bains communicated with a covered boyau running along the sea wall. It was sited in the cellars of two houses and was specially notable for the artistic talent displayed on the walls by its previous French occupants.

The medical arrangements for combined naval and military operations are outlined on p. 181. It was in this camp that the 1st Division inaugurated its own dental service which functioned successfully up to the Armistice and saved much avoidable sick wastage.

Chapter XI is of exceptional interest owing to the necessity for extreme secrecy in the preparations of casualty clearing stations for the Cambrai battle of 1917.

That the medical arrangements worked so efficiently is a tribute to the distinguished originator at general headquarters. The German counter attack proved the folly of having large dumps of medical stores too far in front as had often been pointed out.

The next five chapters deal with the German offensives in 1918. In Chapter XII the general situation and the transition from the offensive to the defensive of the British Armies in France is described.

The strategical disposition of casualty clearing stations in defensive operations was not fully appreciated in all cases, although emphasized by the Director General Medical Services at a conference on March 2. Apparently too, the careful preparation of schemes for a withdrawal by corps and divisions was not adequately carried out. This resulted in the loss of much valuable material and the capture of medical personnel and wounded by the enemy.

Much valuable knowledge may be acquired by careful reading of these chapters which are well illustrated. Chapter XIII discusses the offensive against the 5th Army, Chapter XIV that against the 3rd Army, while Chapter XV is an account of the offensive on the Lys against the 1st and 2nd Armies. The 1st Corps account is somewhat compressed and much of interest omitted. During the Festubert action, 251 casualties of the 55th Division (of which fifty-one were French civilians), were evacuated by the 1st Division. For this assistance the only Victoria Cross gained by a motor ambulance driver during the war was awarded, together with the Croix de Guerre avec Palmes.

After these somewhat disheartening pages, Chapter XVII, which is the advance to victory, is pleasant reading. Undue compression causes the omission of much that would have been of value, such as more detail of the medical arrangements in open warfare, and the march to the Rhine.

In the 9th Corps, the corps main dressing station was so organized by its commanding officer (Acting-Lieutenant-Colonel L. T. Poole, D.S.O. M.C.) that the two parts could advance alternately by a system of leap-frogging, and in this way the dressing station always functioned and kept touch with divisions. The bearer division and one tent subdivision of a field ambulance per brigade, cleared to the brigade advanced dressing station.

This corps also sent a motor ambulance party formed by one heavy car from each field ambulance and one lorry into Germany, to bring in our sick and wounded prisoners. Armed guards were carried on each car, and the little convoy passed through the German rearguard and collected cases throughout Germany. Captain Hart in a car of No. 2 Field Ambulance reached Posen; this is not mentioned on p. 325. It is understood that other corps formed similar convoys.

The history of the medical services with our troops in Italy is contained in Chapter XVIII. The outstanding points are:—

(1) The exceptionally long line of communications ending in France, which necessitated special railway aid posts along the line.

(2) The siting of advanced operating centres close to the front line. These centres were staffed by surgeons, nursing sisters, and had a much more complete outfit than those in France. Immediate operations were possible much earlier, and patients could be retained for post-operative treatment. The natural facilities of the mountainous country were fully utilized in siting the centres.

(3) The adoption of high-powered Fiat ambulance cars, capable of carrying six lying-down cases. These cars were necessary owing to the severe gradients.

(4) The high sickness admission rate from influenza during the months of October and November.

(5) The length of the hand-carry of stretcher cases after the crossing of the Piave, which exceeded anything in France.

The remaining chapters (XIX, XX, XXI and XXII) deal with operations in Egypt; against the Senussi; in the Sinai Peninsula, and in Palestine. The administrative confusion owing to constant changes and overlapping was very marked, and undoubtedly affected efficiency adversely.

Taken as a whole the medical services were most hampered during these operations by difficulties in water supply, transport, and reorganization of medical units when the force became largely Indian, than by battle casualties.

The final battle on September 19, 1918, was one of the greatest victories of the war, and terminated after a cavalry break through and an advance of 300 miles.

Medical units were severely strained by the length of this advance and the hordes of slightly wounded and sick Turkish prisoners. Malaria became rife at the end of this series of engagements. Camel litters, sand carts and sledges were used for medical transport. Roads had frequently to be made by pegging wire netting on the sand.

In conclusion, we think this volume will prove most valuable to the Services generally and to the Royal Army Medical Corps in particular.

TO VENICE AND BACK IN A TWO-SEATER. By E. Halford Ross. With nineteen illustrations from sketches by the author. London: Cassell and Company, Limited. Pp. 235. Price 6s.

To be asked to review a book when the author is personally known to you is not always either a congenial or easy task, especially if one has some faults to find. In this case, the contingency does not arise as we can say at once that this book pleases. It not only pleases but it also educates, because it presents information not easily picked up. The title explains aptly what the book is. It is the simple story of a man and his wife who own a small

car in which they decide to take a month's holiday by motoring from Piccadilly in London to Venice and back. They cross the Channel from Southampton to Le Havre, and thence journey leisurely across the valleys of the Seine, the Eure, the Loir, the Loire and the Cher, through the heart of France to Languedoc and Provence, whence by easy stages they reach the Riviera. Next, having crossed the Ligurian Apennines, the travellers crossed the plains of Lombardy, passing through Milan and Verona, to Maestre where necessarily the car had to be left while a visit was paid to the "queen of the seas." The journey back appears to have been no less intriguing, for it was made through the Italian lake district as far as Iselle, where the car was put on a goods truck and the travellers passed with it through the Simplon tunnel into Switzerland. Thence, over the Jura range, they reached the plains of Burgundy, travelled down the valley of the Yonne until they reached Fontainebleau and Versailles and on home. The whole trip appears to have been done for only £120.

From this summary of the tour, it must not be assumed that this volume is either a motor-tour record or a guide-book. It is neither, nor is it in the ordinary sense a travel-book. It is more than all these, for it is a pleasantly written account of an irresponsible motor trip undertaken abroad by two beginners in motor touring, and a very good time they seem to have had. The author has the saving sense of humour and makes such good use of it that the whole narrative is pervaded with a light-heartedness which removes entirely the seriousness and monotony so characteristic of many books of travel. Some of his digressions into history are not happy, but these lapses are few and far between. Whether many of the places which he depicts in his drawings would be recognized at once by their inhabitants is problematical, but that is of no importance as he claims only to show them as he saw them and as perhaps they may be seen by others. To those who are motorists, this book should appeal because it strikes a new note in travel stories, while, to those who love adventure and the unconventional, it gives a hint to the means whereby a relatively small sum of money may be made to provide a most enjoyable holiday. We congratulate both the author and his fellow-wanderer upon the good use which they seem to have made of their holiday and the very readable book which is the outcome of their peregrination. Perhaps, one or other of them may give us another.

R. H. FIRTH.

SELECTIONS FROM THE WORKS OF AMBROISE PARÉ, WITH SHORT BIOGRAPHY AND BIBLIOGRAPHICAL NOTES. By Dorothea Waley Singer. London: John Bale, Sons and Danielsson, Ltd. Pp. iv and 246. Price 12s. 6d.

Those of us who were at Netley in the time of Sir Thomas Longmore can recall his eloquent references to Ambroise Paré. It is probable that few of us appreciated then the old man's enthusiasm for the subject. If this be so then a perusal of this book will do much to correct our ideas, for it is a most interesting volume about a very remarkable man. Born in

1510, Ambroise Paré is a figure very typical of his country and period. In those days army surgeons were not appointed to regiments, but formed part of the personal and domestic suite of the generals whose troops they were to tend, and in this capacity Paré saw much service during the stormy times in which he lived. Born of humble parentage, Paré did not belong originally to the Faculty but was apparently a medical free-lance picking up his knowledge as best he could and essentially by his own personal observations and experiences. This involved him for many years in a series of controversies with the orthodox surgeons of the Paris Faculty and the College of St. Cosmas. His abilities and the soundness of his views were so marked that ultimately he was accorded professional promotion from the status of "Master Barber Surgeon" to that of "Sworn Master Surgeon of the Brotherhood of St. Cosmas," and in 1554 he was admitted "bachelor" and successively promoted to "licentiate" and "master." Paré's chief crime was that he maintained the superiority of surgery to medicine and pharmacy, thus coming into collision with the Hippocratic Oath which then dominated the practice of the French schools of medicine. It is, however, not without significance that in the campaigns of 1562, after Paré had become first surgeon to the King, we first hear of the services of other master surgeons with the troops, this class of work having been performed hitherto by the humbler barber-surgeons. So long as surgical work was considered derogatory there could of course be little progress in the art.

No one can read this book without coming to the conclusion that Paré was a great man, an original thinker and within the limits of the period in which he lived, also a good surgeon. He made three great definite contributions to the surgical art. He discovered that gunshot wounds were not poisonous and therefore did not require the application of boiling oil but were best treated by soothing applications; secondly, he established the cognate doctrine that hæmorrhage after amputations should be arrested not by the terrible method of the cautery, but by simple ligature; and thirdly, he advocated the method of podalic version of the child before delivery in cases of abnormal presentation. In addition to these matters, Paré wrote voluminously on the whole range of surgery. The French editions of his works followed one another in quick succession. The fifth edition, prepared by himself, was published posthumously in 1598, Paré having died in 1590. The first English edition appeared in 1634, being a translation by Thomas Johnson, an eminent botanist and royalist surgeon. The present volume consists of extracts from Johnson's translation, in which his quaint spelling is retained. The extracts are chiefly from Paré's Book XI which embodies his historic first work and also others from his final book summing up the surgical experience of his long life. These are all delightful reading, more particularly those which Paré calls his "voyages," as they convey a clear idea of the personality of the kindly, humorous, shrewd, old surgeon.

It is many years since we have read a book dealing with professional matters which has given greater pleasure, and we congratulate both the editoress and the publishers upon the issue of a medical classic which should be in the library of every doctor. Paré lived in times when religious strife was at its bitterest in France. Few retained a clear head in those days, but Paré was one of them, and the stately progress of his well-ordered, useful and merciful career is outlined in this book, showing bright upon a dark stage.

R. H. FIRTH.

NOTES OF THE TREATMENT OF MALARIA WITH THE ALKALOIDS OF CINCHONA. By W. Fletcher, M.D.Camb. Bale, Sons and Danielsson. Pp. viii + 91. Price 6s. net.

This volume is No. 18 of the Studies from the Institute for Medical Research, Kuala Lumpur. The author gives the results of series of cases of malaria treated with various alkaloids of cinchona, and in the main his findings support those of other workers. Unfortunately he was unable to investigate the question of permanent cure of the disease, and his experiments were concerned chiefly with the treatment of attacks without reference to subsequent relapses. Regarding cinchona febrifuge, he found that a dosage of ten grains twice a day is as efficient as quinine and not more toxic. Unfortunately the composition of cinchona febrifuge is not defined by law, and the proportion of the various ingredients vary and adulteration is easy.

The research included investigations on the different methods of administration of quinine. Rectal injections he unequivocally condemns as causing severe pain with the passage of membranous shreds and blood-stained mucus. Moreover, quinine could not be detected in the urine of any of the cases treated thus.

His investigations in the matter of intramuscular injections lead to the conclusions, amongst others: "It is unjustifiable to employ quinine injections in ordinary cases of malaria when the patient can take the drug by the mouth. It is equally unjustifiable to withhold injections in very serious cases when the patient's life is in danger." He points out that many of the apparent failures of oral quinine are due to the prescribed doses not being taken. In one hospital 116 patients, nominally receiving twenty grains of quinine daily, were examined, and twenty-seven of them showed no quinine in the urine. To these Dr. Fletcher repeated the dose himself, with the result that quinine appeared in the urine of them all. From these and many similar experiences he considers that at least a quarter of the quinine prescribed in native hospitals is not swallowed by the patients. He emphasizes the importance of controlling quinine administration by frequent urinary tests.

The book concludes with an interesting section on quinine resistance. Details are given of the investigation of a number of cases of supposed

quinine resistance, and in all of these the resistance was apparent and not real. Most of those called on to investigate similar cases have had the same experience as Dr. Fletcher.

The publication will interest all who are concerned in the treatment of malaria, and is a worthy successor to the previous volumes issued by this institute.

W. P. MACA

VENEREAL DISEASE: ITS PREVENTION, SYMPTOMS AND TREATMENT. By Hugh Wansey Bayly, M.C. Second Edition. J. and A. Churchill, 1924. Pp. xiv and 176. Price 7s. 6d.

This book, republished after five years, gives in a concise form the present-day knowledge of venereal diseases both as regards symptoms and treatment. In the first chapter the author puts forward a plea for efficient prophylaxis, particularly as regards education and legislation.

In Chapter II the symptoms of syphilis in its various forms are described clearly and concisely. A chapter on laboratory work and one on modern treatment follow.

The next section, on gonorrhœa, is also good, although some practitioners might object to the dogmatic tendency of the author with regard to treatment. However, those who require a definite line to work on, will find this section of great assistance.

The book concludes with a chapter on non-specific lesions and one on routine in private practice.

The description of technique is particularly good throughout. The illustrations, though not very numerous, are sufficient.

This book should be especially useful to those who have been out of practice with regard to venereal disease and who, with a limited time at their disposal, wish to refresh their knowledge on the subject.

F. D. A.



Notices.

EDITORIAL NOTICES.

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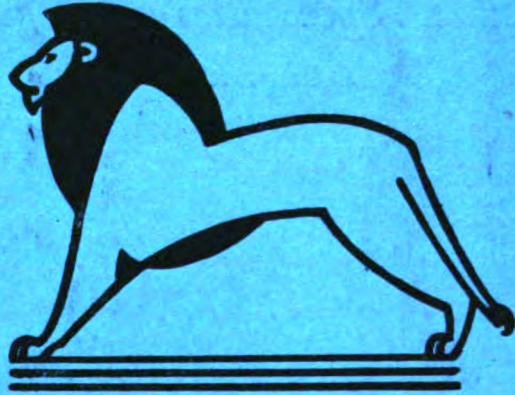
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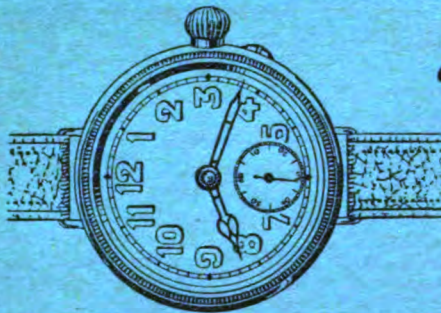
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Original Communications.

THE RECENT TREND OF MILITARY HYGIENE.¹

BY LIEUTENANT-COLONEL J. A. ANDERSON.

Royal Army Medical Corps.

Professor of Hygiene, Royal Army Medical College.

To the worker in any branch of science there is profit if occasionally he pauses and surveys the backward road over which he and his work have been progressing. The daily path is so full of twists and turns, of corners and blind alleys, that the sense of general direction becomes blunted; local events and current activities distract attention from general principles; and it is only through regarding the present position in comparison with former stages that it becomes possible to appreciate the broad lines and the true direction of the whole advance.

In the subject of military hygiene the present time is particularly suitable for such a retrospect. From 1914 to 1918 not only did our former ideas and methods suffer the very searching test of modern war, but novel problems, unexpected difficulties, unaccustomed tasks were presented almost daily, each and all of them demanding effective solution and performance. That the medical service of the Army came through this test with credit says as much for its adaptability as for its efficiency. Further, sufficient time has now elapsed since the end of the war to permit that sorting out of mixed experiences, and somewhat nebulous ideas, that digestion of raw facts and phenomena, which are essential if they are to be profitable guides for our future efforts. Lastly, there have recently been published as part of the "Official History of the War," two volumes dealing solely, if not very completely, with the "Hygiene of the War."

¹ Read at the meeting of the War Section, Royal Society of Medicine, April, 1924.

These are amongst the considerations which led me to select "The Recent Trend of Military Hygiene" as a subject for discussion to-night.

There has occurred during the past twenty years a gradual but momentous change, almost a revolution, in our conception of military hygiene, naturally most marked in the past ten years which included the Great War and its results. These changes are not limited to improvements in organization or in methods such as would result merely from the normal development of scientific knowledge during the period under review; they strike much more deeply and affect even the primary essential aims of the subject. And only to a certain degree, one must confess, have they been the fruits of new discoveries in the domain of hygiene itself; in far greater measure they have been the product of two factors: in the first place that hygiene, more than ever before, has been using and turning to profit the new work of other—and sometimes not apparently allied—sciences, and in the second place that the combatant branches of the Army have gained a more adequate appreciation of the close relationship between healthy living and efficiency.

It appears to me that the evolution of present-day military hygiene, the direction in which it has progressed during recent years, and, possibly, the lines on which future developments may be anticipated, will best be realized and most clearly understood if I select certain aspects of the subject and for each of them compare not so much the methods—which may change from day to day or even from hour to hour—but the outlook, the point of view, of yesterday with that of to-day. Before doing so, however, there is one thing I would emphasize, one point I would like to make very clear, and this is that such a comparison is in no sense one between our predecessors and ourselves, there lies no suggestion of criticism or disparagement of those who in their day so well and truly laid the foundations of the existing structure; there lurks, I assure you, no inferential claim that with their knowledge I—or you—would have bettered their results or that given our present opportunities their work would not probably overmatch anything that you—or I—are doing to-day.

The control of infective diseases may be selected for first consideration from amongst the many and varied duties of preventive medicine, as being that aspect of its practice which most strongly appeals to the community at large. In fact to the man in the street the existence of the commoner infective diseases usually represents the only justification which he knows or can understand for the appointment of a health department. And there are several very obvious reasons for this point of view. As a branch of public health work it is essentially spectacular, its success is frequently dramatic, the growth of bacteriological knowledge places it from day to day upon a more secure basis, and, in the words of an American writer, it is "in accordance with a general rule, which governs all mankind, namely, that of doing first the simplest, crudest, and most necessary thing."

The contents of the annual reports of the Army Medical Department

for the ten years before the commencement of the European war are a striking proof of this infectious obsession. Year by year, page after page is filled with records of the incidence of infective disease at home and abroad, in the vast majority of cases unaccompanied by any attempt at analysis or comment on the reasons for such incidence. There are occasional brilliant exceptions, one of which, the history of investigations into enteric fever in India, furnishes an invaluable picture of a gradually changing point of view in regard to the causation and control of infective diseases in general. There we find early attention devoted largely to places and things as sources of infection, especially to water supplies; gradually it is realized that the danger lies not so much in water which may possibly be contaminated by excreta, but in the excreta themselves, and thus preventive measures are definitely directed towards the known channels by which the disease is being spread rather than to a haphazard process of cleaning up; and the final step is the recognition of the human body as the breeding ground and storehouse of the infective organisms. There naturally follows the development of measures for the better control of the infective individual, increased laboratory facilities for the more rapid diagnosis of early cases, stricter isolation of doubtful cases, provision of depots or centres for the segregation of convalescent cases until proved non-infective by laboratory examinations, and the issue of an order prohibiting men with a history of enteric fever from being employed in cookhouses or on duties involving the handling of food or drinking water. Beneficial though these measures proved, they possessed the cardinal defect that they were directed entirely against the source and route of infection; practically, they ignored the susceptible recipient. It was only when the protection of the not yet infected individual was taken in hand that a satisfactory measure of success was obtained. I refer of course to anti-typhoid inoculation, the effective use of which in India dates from 1906. And it was this combination of measures, mobile laboratories for early and rapid detection of infective persons, segregation and laboratory control of convalescents, and effective vaccine protection of all troops, which produced the novel discovery in the late war that enteric fever can be rendered a negligible factor in the health of an army in the field.

This history of enteric fever clearly shows the evolution of the modern point of view in regard to infective diseases and I suggest to you that the lines of advance have been in two directions: first, in paying attention to the individual, to persons rather than to things or places, as the true source of infection requiring to be controlled or disinfected; secondly, in recognizing the importance of the healthy susceptible as an item in epidemiology, and the necessity for increasing his personal protection by assisting Nature's defences both specifically and generally. Where an infectious disease is being effectively controlled, there you will find these two principles in active operation.

Enteric fever in India, which I have quoted as an example of control

in infective diseases, will serve also as an introduction to my next consideration. In 1904 enteric fever represented a fraction over two per cent of all Army hospital admissions in India; even if admissions for what were called "other continued fevers" be added, the total comes to less than five per cent of the total admissions. Far more important from the point of view of military inefficiency were such disabilities as venereal diseases giving 22 per cent of all admissions, diseases of the digestive system furnishing 11½ per cent, minor septic conditions and skin diseases 7 per cent, and injuries 11 per cent. Similarly, amongst troops at home for the ten years from 1904 to 1913, infective diseases were responsible for only nine per cent of all hospital cases, being far exceeded by such other causes as venereal disease 18 per cent, disorders of the digestive system 17 per cent, skin diseases and minor septic conditions 12½ per cent. And it must be remembered that in these figures, striking though they may be, the real comparative unimportance of infective diseases is not truly apparent. The figures represent admissions to hospital and therefore every infectious case is necessarily included, but amongst the other diseases there is no indication of the large numbers—at least as many again—treated in barracks. Yet save for some pious expressions of opinion on the subject of venereal disease, there is little evidence to show that these causes of sick wastage received any preventive attention whatever. In considering military hygiene the textbooks of that period (and official manuals were no exception) usually commenced with one or more chapters upon the more important diseases affecting a military population, from which the unprejudiced reader could only conclude that the soldier was not assailed by any diseases except those of bacterial or protozoal origin. Occasionally there might be found an apologetic lapse into heterodoxy and the brief mention of such conditions as scurvy, alcoholism, or heat stroke. Preventable disease was a synonym for infection. On the whole it must be admitted that some good results were obtained. Amongst troops at home during these ten years, though the incidence of infective diseases shows no diminution whatever when compared with the incidence of other diseases, yet the general sick rates, in accordance with the well-known epidemiological law, decreased year by year in an extremely satisfactory manner.

One gains the impression that it was the stern requirements of the war, the overwhelming necessity to keep every possible man in the fighting line, which bred a new outlook. It became the obvious duty of the medical service to prevent, or at least control, the enormous wastage of man power due to such causes as trench-foot, shell-shock, cardiac affections, dental caries, heat stroke, food deficiencies, nephritis, myalgia, and many other non-infective diseases. And, perhaps most illustrative of all, it was to the medical services that the Army turned in these critical days of April, 1915, counting upon them to evolve defensive measures against the new gas-warfare. I doubt whether it is adequately realized that for two and a half years (until October, 1917) research on respirator design and the provision

of respirators—in fact the whole responsibility for investigations into gas defence in this country as regards the Army—rested upon the hygiene branch of the Army Medical Services. At last the practice of military hygiene had escaped from the strangling restrictions of infection, and, fortunately, this freedom not only survived the war but is still evident to-day. The annual reports on the health of troops from Commands both at home and abroad bear evidence that attention is now being paid to the greater causes of sick wastage, the non-infectious diseases, as well as to the lesser, the infectious group. In some instances there is reported an endeavour to reduce the incidence of accidents and minor injuries, a group which consistently stands very high as a cause of hospital admissions not only in our own but in all armies.

In this sector of the hygienic front the direction of advance is evident. It lies in a far wider conception of what constitutes preventable disease, in a realization that the ordinary infectious diseases furnish only a fraction of the great total of hospital admissions, which represents the sick wastage of the Army, and, therefore, in the inevitable acceptance by the medical service of a greatly increased responsibility for and a much more detailed interest in the everyday activities of the soldier. It has produced the wise medical officer to whom a case of smallpox is less disturbing than half a dozen cases of indigestion due to faulty cooking or messing arrangements in their unit.

It is evident—and it was generally accepted as its true function—that military hygiene in the past concerned itself chiefly with the more obvious, more immediate problems of death and disease and frequently with only a minor group of these, the infections. Concern with the welfare of the healthy man was scarcely recognized, or, if practised at all, was strictly environmental. It was very inadequately realized that the essential aim of hygiene is a double one, not only the prevention and control of disease, but also the maintenance and improvement of health. And these two, though often so regarded, are by no means the same thing; a recent writer has defined the difference as that between a business man who merely escapes bankruptcy and one who makes a fortune. It is a well-established fact that the sick statistics of a unit or a formation are furnished by a very small percentage of the total troops, and until lately little attention was given to the health interests of that much greater number who, owing to their freedom from actual sickness, were counted of hygienic unimportance. So far as I am aware the importance of this point was first specifically emphasized when Colonel Melville, at that time Professor of Hygiene at the Royal Army Medical College, published his book on military hygiene in 1912. In it he writes as follows: "Every medical officer of any experience knows that the sick list is furnished by comparatively few men in any unit; the great majority never see the inside of a hospital. It is on this great majority, which I should feel inclined to put at a strength equivalent to seventy-five per cent of the whole army, that the eyes of the medical officer

should chiefly be fixed ;" and, again : " It is the duty of the military medical officer to see not only that he [the soldier] keeps clear of hospital, but also that he possesses in the highest degree all his physical powers." For the then existing state of affairs in which the medical officer by general consent was expected to concern himself chiefly, if not solely, with disease, several reasons may be advanced : the fixed belief in statistics of actual sickness as the true index of health and the admitted difficulty of giving a statistical representation of changes in physical health short of positive illness ; a natural and justifiable desire to give first attention to the matter of greatest urgency, to the most evident evil, to the condition threatening most harm ; and, above all, a lack of knowledge of how best to care for and operate the human body as a machine. We knew the human body in disease because we had studied it, but the science of maintaining it at a maximum degree of health and efficiency was almost unexplored territory. In fact, though we could drive the human motor-car well enough to avoid collisions or other serious accidents, we were not sufficiently expert to obtain the maximum " miles per gallon."

It is a common observation that the progress of any science is marked by periods of slow accumulation of facts and ideas and periods, when, owing to some new point of view, the accumulated material suddenly fits into place and the whole subject is revolutionized. So it has been in this matter of personal hygiene. For generations the science of physiology has been accumulating theories and facts about the normal human body, which were studied almost entirely in relation to disease ; only recently has there arisen the new point of view that this knowledge can be studied with much more profit in the pursuit of health.

Recent advances and discoveries in physiology have done much to place the practice of health—as distinct from the mere avoidance of disease—upon a definite and scientific basis. There is no lack of instances ; investigations by various observers into the physiology of muscular work, collated into a comprehensive monograph by the late Professor Bainbridge, have given us a sound understanding of physical training and marching. The recent work of Professor Cathcart of Glasgow, assisted by several army medical officers, has furnished us with definite physiological data on which to base recommendations in regard to the load of the soldier, the speed of his march, and the necessary energy value of his ration ; other considerations in the construction of a ration adequate for health have become disciplined factors now that more precise information about vitamins, protein-metabolism, and food values is available ; a fairly complete physiological knowledge of the control of body heat affords a rational basis for advice in regard to water drinking on the march ; and the whole subject of ventilation has acquired a new exactitude by the application to it of the physiological investigations of Dr. Leonard Hill. Perhaps the occurrence most significant of the change is the publication by the War Office, in the beginning of 1919, of a small pamphlet written for the instruction of the soldier him-

self and entitled "Elementary Physiology in its Relation to Hygiene." Further evidence of the increasing desire for a constructive health policy is seen in the establishment after the war of the Army Dental Corps, whose duties include not only dental treatment, but also instruction in dental hygiene and the performance of an annual dental inspection. It is also instructive to note that in the United States army the annual medical examination of all officers, formerly limited in purpose—as in our Army to-day—merely to determining the present fitness of the individual for active service, has recently been expanded, even transformed, and the furnishing of data on which to base advice in regard to maintaining the health and increasing the physical efficiency of the person examined, the detection of minor physical defects or early conditions of ill-health, and the recommendation or institution of measures for their correction or prevention are now regarded as the primary objects of these yearly examinations.

It will be seen that in these examples we have evidence not so much of changes in methods as of the development of a totally new responsibility—the study of health with a view to its promotion rather than of disease with a view to its prevention, an awakening consciousness that Hygiene can offer to human life something of immeasurably greater worth than merely not being ill. To a certain extent this policy may be regarded as a logical development of that tendency to which I have already referred in discussing the control of infective diseases, namely to attach increasing importance to the resistance of the not yet infected individual, to devote attention to the soil as much as to the seed of disease, to prefer fireproofing to fire-extinguishing.

The attitude of Hygiene towards external environment displays a similar bias towards health. Sanitary engineering was formerly studied with the sole object of preventing excretal infection, systems of ventilation were designed to avoid the chemical impurities of foul air, analyses of food and water were performed to determine the absence of what was bad to eat or drink, not the presence of what was good, the outside world was eyed askance as being unfriendly and full of lurking dangers. Perhaps in the matter of environment our views have not advanced to as great an extent as in other directions, but sanitary engineering now brings to its work the added considerations of convenience and comfort in life, ventilation has become a problem of providing that physical atmospheric environment most beneficial to the human organism, and foods are examined as to their content of those principles essential for health. Recently even water supplies have been similarly investigated in regard to the presence of an essential element (iodine). And gradually, bit by bit, are we approaching the conception that external environment is not so much a thing to fear or to fight against, but is more truly something which, properly controlled, holds important possibilities of co-operation and assistance in this matter of healthy living. If the correctness of this

conception be admitted, it follows that the sound medical officer can no longer afford to limit his concern only to those factors in environment which may produce disease, but must be prepared to advise upon, and therefore must be in touch with every item in the whole range of the soldier's army life; there results, to repeat a phrase which I have previously used, a much more detailed interest in the everyday activities of the soldier.

In civil public health affairs the evolution of industrial hygiene as an integral branch of preventive medicine has taken place only within recent years, and popular belief, when hailing this newcomer as the newest member of the public health family, appears to have lost sight of the fact that military hygiene (including both the Army and the Navy) is at once the oldest and most extensive example of the application of hygiene to a special industry. The effects upon the soldier's health of his special circumstances and duties have been subjects of study and investigation by military authorities from the early days of history. Ancient military writings contain much advice on such matters as the selection of recruits, marches, exercise and physical training, and even the oldest of such literature enunciates principles of healthy living which have a humiliating resemblance to those we are busy rediscovering to-day. The motive, however, underlying all such work was primarily the avoidance of disease and the maintenance of health, while increased working efficiency was neither sought for nor expected, except in so far as it might result from improved health. Of very recent birth is the conception that the soldier's work and duties can be studied with advantage not only from the point of view of health, but also with the deliberate intention of increasing his efficiency, of eliminating unnecessary expenditure of energy, of discovering the most economical way of using human effort in the performance of a specified duty.

Amongst such investigations may be mentioned certain experimental marches carried out at various times, although the original purpose in every case was to test the value of a ration. There was the experimental march of Parkes in 1875, performed to determine the relative values of coffee, extract of beef, and rum as restoratives, a march made by a company of the West India Regiment at Sierra Leone in 1907 to determine the most suitable scale of rations for the West Indian soldiers on active service, and two experimental marches, the first in 1909 and the second in 1910, under the direction of Colonel Melville, at that time Professor of Hygiene at the Royal Army Medical College, to test the adequacy of the existing field service ration. Although rations were thus the primary concern, these marches gave opportunity for investigating a number of factors which affect marching efficiency, and the 1910 march, for example, produced several modifications in the existing regulations for infantry training.

The data obtained from these marches were based upon loss or gain of

body weight, alterations in body measurements, and the subjective sensations of the victims, and therefore were open to considerable error. Advances in biological laboratory methods furnished the means for observations of much greater precision, and, during the war, when shortage of food made it probable that preferential treatment would have to be given to the army population, especially to young recruits under training, a series of investigations was carried out by Cathcart and Orr. The method employed was that of Douglas and Haldane, the expired air being collected in the Douglas bag during different exercises, and samples analysed by the Haldane apparatus. The immediate object of this inquiry was to ascertain the amount of energy expended by an average recruit during the various parts of his training, from which could be found the necessary energy value of his ration, and therefore it was essentially a health question; but many of the observations were found to have an important bearing on the working efficiency, as distinct from the actual health, of the individual.

It was evident that there existed a wide field for inquiry in regard to the soldier's duties, directed towards determining optimum conditions of work, i.e., the conditions furnishing the greatest economy of physical effort consistent, of course, with health. During the past five years a number of investigations have been undertaken and results of considerable importance have been obtained. Time does not permit a lengthy discussion of these results, but one or two examples will illustrate this recent "energy economy" outlook of military hygiene. There was a valuable historical survey by Lothian dealing with the load carried by the soldier from ancient times to the present day, which furnished an abundance of exact data and enabled us in the first place to judge the question in the light of actual past experience. Cathcart and Lothian, investigating the present pattern of web equipment, showed that minor modifications of certain straps afforded a reduction of as much as seventeen per cent in the actual cost of carrying the load. Cathcart, working with Lothian and Greenwood, determined the effect on energy expenditure of marching at various speeds (the optimum rate proved to be ninety yards per minute), and along with Richardson and Campbell demonstrated that the maximum economic load for a marching man represents forty per cent of the body weight under favourable laboratory conditions, which should be reduced to thirty-three and one-third per cent for field conditions. Cathcart and Orr, while investigating the energy expenditure of the infantry recruit, showed that considerable latitude might be allowed in the distribution of the load without materially influencing expenditure, but did not question the earlier work of Zuntz and Schomberg, who showed that the cost of carriage of an asymmetrical load, such as a rifle, is considerably greater than that of the same weight symmetrically distributed. Stevenson and Brown (the latter an officer of the Royal Engineers) in 1921 undertook an investigation into economy of effort in trench digging, initiated at the request of the Royal Engineer Board; this piece of work possesses special interest in that it is,

perhaps, the example most strikingly indicative of the new association between military hygiene and industrial efficiency, and because it represents, as far as I am aware, the first application of scientific time-and-motion study to military duties. The report has recently been published in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, and it will be sufficient to note here that there was evolved a new pick and shovel drill giving an increased digging efficiency of about twenty per cent.

I have discussed this aspect of military hygiene at some length, as it represents at once the most recent and the most far-reaching development of the subject. Looking at the last example which I mentioned, namely, economy of physical effort in digging, it would be difficult to imagine an outlook more definitely in conflict with the old narrow-minded conception of Hygiene, as interested solely in diseases—that superficial point of view which but a year or two ago led to the authoritative but somewhat benighted declaration that “public health is now largely applied bacteriology.” Far from it! The effectiveness of sound hygienic measures cannot be measured entirely in terms of disease, because most of its present-day work has to do not with disease but with health. This fact reveals itself, if not in everyday action, at least in everyday language, for there exists a Ministry of Health, not of disease, and we collect *vital*, not *mortal*, statistics. What Hygiene sets out to accomplish in the Army is not merely a reduction in disease, but a positive increase in the sum total both of health and of working efficiency. And our pursuit of the latter implies, as I have emphasized more than once this evening, a much wider and more detailed concern with the whole life and work of the soldier.

The health of a limited community, such as an army, is closely dependent upon the quality of the raw material, and any marked carelessness in the medical examination of men presenting themselves for enlistment will tend to introduce into the Army recruits in whom no subsequent hygienic endeavours can either produce or maintain a satisfactory degree of physical fitness. Hence recruiting in its medical aspect becomes an important function of military hygiene, and the branch of the medical service responsible for the health of the army community clearly must also control the medical selection of individuals for admission to that community. Further, the recruit is usually a young immature lad, frequently under-fed and ill-developed, and the nature of his early physical training at the regimental depot is a factor of so great importance in determining his future health and fitness that this also must be closely supervised by the medical service. In the Army the necessity for such co-ordination has recently been recognized, and the medical examination of recruits, along with the medical aspects of physical training, is now supervised and controlled by the Director of Hygiene at the War Office. Here also we have a further instance of the manner in which modern military hygiene day by day is being compelled to include wider interests and to undertake far more comprehensive responsibilities.

In regard to the actual medical examination of recruits there has been little change in recent years. There is evident, nevertheless, a distinct leaning towards more precise and definite standards for various conditions, leaving less opportunity for the often erratic personal discretion of a recruiting medical officer at an outstation and tending to a more standardized type of recruit. Thus, for example, there is now a more or less fixed arithmetical definition of dental sufficiency, and the problem of a standard functional cardiac test is at present under consideration. More important, however, because it conforms to the general line of development of the whole subject, is the tendency to examine the recruit not solely as to his freedom from pathological conditions, but also as to his positive fitness for his future work. Thus in the infantry recruit his weight must be considered in relation to the load which he will have to carry on the march, the psychological stress of modern warfare demands consideration of the man's nervous stability, an educational standard is now imposed, and the value of a possible intelligence test is being seriously considered. It is interesting to note a similar tendency in civil industries, in some of which vocational selection tests have obtained a definite footing.

The existence of an organization specially devoted to the control and supervision of health matters in the Army dates back little more than some twenty years to the first appointment of a specialist sanitary officer for each military district at home. It was the experience of the South African War which brought the change into being, when it had become evident that effective sanitary organization and supervision could not be performed by the casual holder of some other appointment; and in the recent great war, few expansions can compare with that of the sanitary service from its 7 officers and 116 other ranks in August, 1914, to a total of 17,000 officers and men in the various theatres of war at the time of the armistice. The present peace organization was officially authorized in September, 1919, when there were created at the War Office a Directorate of Hygiene, and in Commands at home and abroad the appointments of assistant or deputy-assistant directors of hygiene, the latter replacing the previous specialist sanitary officers. At the same time a corresponding Directorate of Pathology was established and an active service organization for both these branches was promulgated.

In regard to the activities and duties of assistant or deputy-assistant directors of hygiene in Commands, the recent developments, as would naturally be anticipated, merely reflect the various changes in outlook which have already been considered. Originally the activities of the sanitary officer seldom went beyond matters of external environment—barracks, water supply, disposal of refuse—or the investigation of actual outbreaks of disease. He occupied a laboratory in which he did a certain number of chemical analyses and a rapidly increasing amount of bacteriological work, and from which he issued forth on sporadic excursions to combat an insanitary drain or an infectious disease. To-day the actual

technical performance of laboratory work is relegated in large part to the specialist in the particular subject, to the sanitary engineer, the bacteriologist, the analytical chemist, the physiologist, and the true laboratory of the present-day sanitary officer lies in the barracks, the camps, the surroundings, the work and duties, in the flesh and blood and human life of the troops whose health and physical efficiency he supervises. More than ever he must concern himself, must keep in the most intimate touch with, every single item of all these diverse activities which constitute the daily life of the man in the ranks.

If this vast extension in the scope of military hygiene is accepted, if it is true that there is nothing in the military heaven and earth which does not to some degree affect the health, the welfare, the working efficiency of the soldier, and therefore nothing which does not become a legitimate concern of the hygienist, it may be argued that hygiene in the Army at once becomes identical with the sum total of the administration of the Army and might logically presume to take the place of the whole existing organization. This would be a justifiable and insuperable criticism if there were claimed not only the duty of advising on all these matters, but in addition the responsibility for their efficient execution. It is, however, an essential principle of our army organization that responsibility for carrying out "all measures necessary for the preservation of the health of those under him" rests definitely upon the unit or formation commander, who is also responsible for the due observance of sanitary orders by all under his command.

The medical services, therefore, can advise and can supervise, but execution means combatant co-operation, and this co-operation must be not only fervent but based upon knowledge. Education of the whole army community in health matters is essential, and in the practice of hygiene in the Army no greater advance has been made in recent years than has taken place in this respect. Prior to 1906 general instruction in sanitation was limited to a few desultory lectures organized locally in commands and intended primarily for the instruction of medical rank and file; but in 1906 the Army School of Sanitation was established at Aldershot for the instruction of regimental officers and men. The importance of sanitary education throughout the Army year by year became more evident and in 1912 the Director-General stated in his annual report, "It is quite probable that the present satisfactory low incidence of disease can only be maintained by increasing attention to the details of hygiene and preventive medicine on the part of regimental officers and non-commissioned officers and indeed the rank and file themselves." During the war sanitary instruction for the regimental officer and man was greatly extended; in addition to well-organized and fully-equipped schools at home, such as those in London, Leeds and Blackpool, schools and training-centres were established in every expeditionary force and were not limited to the base or the lines of communication, but were found as far forward as army and even corps areas.

This feature presents a definite and unmistakable line of development, making clear this principle that adequate sanitation can never result from the single-handed efforts of any medical service, that it must always depend upon the cordial and the educated co-operation of the rest of the community both as a whole and as individuals. Its aim is the production of what has been called the "personal sanitary conscience." It is only where this exists that even the finest sanitary organization can prove effective, and in the official "History of the War" you will read that "It was in fact the influence of the individual probably more than of the system which was responsible for the maintenance of a high standard of health and the resulting high standard of efficiency amongst British troops. That this influence pervaded the expeditionary forces during the war is in great measure due to the efforts made by the numerous schools of sanitation, as well as to the instruction which had been carried out previous to 1914."

The concerns of military hygiene are so many and so varied that it is not easy to select lines of recent development which shall be characteristic of the subject as a whole. Nevertheless if one examines the evolution of the present-day point of view in each of these provinces which I have mentioned—infections, other diseases, health, environment, working efficiency, recruiting, organization—there become evident some general tendencies common to them all.

There is certainly, in the first place, an increased—and an increasing—appreciation of the importance of the individual, an attention to persons rather than to things and places, a leaning towards physiology instead of towards sanitary engineering. It is an outlook in which the soldier's body holds equal interest with his barracks, the development of his physique ranks at last on an equality of importance with the disposal of his fæces, and the man himself is considered as an integral part of his environment.

Secondly, there is evidence of a definite orientation towards health rather than towards disease, a persuasion that in the precept "Eschew evil and do good" the latter injunction is the more important, that to improve the health of the many is in every way as vital a hygienic duty as to keep the few out of hospital. Inevitably there follows a logical extension of this principle, so that not only the promotion of health, but, in addition, the improvement of working efficiency becomes a legitimate function of military hygiene. The selection of recruits best adapted for their future duties and the elimination of wasteful methods in the performance of these duties are examples of this policy.

The third development lies in the enormously increased scope of the subject, so that its advisory range, to quote from the Regulations for the Army Medical Services, now includes "any precautionary or remedial measures relating to stations, garrisons, barracks, hospitals, movements, food, transports, encampments, billets, bivouacs, dress, physical training, drills, duties, and" (lest perchance any item whatever in the soldier's life may have been overlooked) "all other matters which may conduce to the

preservation of the health of the troops and the mitigation or prevention of disease in the Army." With so great a diversity of important interests it is evident that the specialist in a single particular branch merely as such can no longer claim to dominate the subject as a whole. In fact, the more he knows of his own subject the less useful, except for strictly technical assistance, is he likely to be, as he is not in a position to visualize the situation from any other than his own restricted point of view. No longer does the skilled engineer, the trained bacteriologist, the expert chemist, thereby become at once a well-equipped practitioner of Preventive Medicine.

Lastly, there has been an increasing recognition of the fact that an essential part of hygiene is the education of the whole community; that every individual must co-operate, and that this co-operation must be based upon knowledge. Hence the result that military hygiene includes not only the work of experienced specialists, but also measures for teaching the principles and practice of healthy living to every officer, non-commissioned officer and man throughout the Army.

The various developments which have been considered and the examples which have been mentioned have naturally been limited to the practice of hygiene in the Army, as it is only with that aspect of the subject that I can claim full acquaintance. There is little doubt, however, that the tendencies are universal and may be recognized in every branch of Preventive Medicine. Even in civil public health, where progress must be slow until a far higher standard of health education permeates the masses, work in industrial hygiene, among school children, and in maternity and child welfare, points to an outlook gradually escaping from the yoke of disease. And I hope that in the subsequent discussion we may hear from representatives of the other fighting services their impressions of the general lines of advance in their respective provinces. There must be developments of interest, for example, in the special problems which face the Navy in dealing with a community occupying a rigid and restricted environment, and the work of the Air Force in the medical examination of flying candidates is a unique example of the "vocational selection" aspect of an industrial hygiene.

I fear that I have been somewhat discursive to-night, and that I must have enlisted from amongst you a good many sympathizers with the essayist who declared that "there is nothing in nature so irksome as general discourses." My object has been to bring to your notice in what manner and to how great an extent military hygiene has been compelled to change its point of view within recent years, and inevitably to take upon itself vastly increased responsibilities. And in these days of rapid change and progress there is profit to be found if occasionally we obey the old counsel "that we make a stand upon the ancient way, and then look about us, and discover, what is the straight, and right way, and so to walk in it."

THE PRINCIPLES OF THE PROPHYLAXIS OF MALARIA: WITH THE ADMINISTRATIVE AND OTHER MEASURES FOR THEIR APPLICATION ON ACTIVE SERVICE.¹

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THE association of epidemics of malaria with military campaigns in tropical and subtropical countries has been well known for many centuries. Frequently has it been brought home to invading armies that the natives of malarious regions possess in the unhealthiness of their climate a means of defence more potent than the scientific weapons of modern warfare, and that unless vigorous action is taken against the insidious and ever present menace of disease, the attainment of the goal will involve an expenditure of human life and health out of all proportion to the aggressiveness of the human enemy. Many a campaign has been doomed prior to its inception by failure to realize these facts, and through lack of appreciation of the terrible potency of this most protean of diseases sent to a fate as inevitable as it should have been obvious.

To illustrate this it is only necessary to refer to a few examples. In comparatively recent times prior to the Great War of 1914-18, perhaps the Walcheren Expedition of 1809 is the most outstanding. This was undertaken in late summer and autumn, despite the fact that malaria is notoriously prevalent at this season, and very soon an epidemic of appalling magnitude was in progress, so that by the middle of September it was estimated that two-thirds of the force were sick and deaths averaged twenty-five to thirty a day [1]. The epidemic reached its zenith about the end of September and thereafter decreased in volume, but the army which finally returned to England in December was a decimated and broken one. Though it had suffered only 247 casualties from fighting, it had lost over 4,000 dead—from the ravages of fever.

A similar fate overtook the Ashanti campaign of 1864, and in more recent times the French Madagascar expedition of 1895. In all these cases the deadly power of the disease when unrestrained was clearly demonstrated, and it was made very evident that a campaign in a malarious country would be a success or failure according to the thoroughness of the steps taken to protect the combatants from malaria. The truth of this was again brought home during the late war, notably in Salonica, Palestine, and East Africa. In Salonica during the first malaria season there were over 30,000 cases among the British troops, and in subsequent years the number increased rather than diminished [2]. In Palestine after the

¹ "Parkes Memorial Prize Essay."

advance from the Auja line the army was decimated by malaria : whilst in East Africa from January to November, 1917, there were 21,000 cases [3].

These examples merely serve to illustrate the deadly effect of an epidemic of malaria on a fighting force, and to emphasize the necessity for prophylaxis.

LIFE HISTORY OF THE MALARIA PARASITE.

In order to appreciate the various lines along which malaria may be attacked, it is necessary to bear in mind the life history of its parasite. This was elucidated in 1897 by Sir Ronald Ross, who by a process of analogy and deduction conceived the possibility of a blood-sucking insect acting as intermediate host, and finally succeeded in proving that certain species of anopheline mosquitoes were the responsible agents in the transmission of malaria from one individual to another. Very briefly the cycle of development is as follows : The youngest form of the parasite in man penetrates and grows in the red blood corpuscles, reaching maturity in forty-eight or seventy-two hours according to its type. As it approaches maturity it divides into a number of small forms, the merozoites, which eventually split apart and are liberated by the rupture of the containing red cell. These rapidly penetrate adjoining red cells and in their turn undergo development. This reproduction by an asexual form of multiplication is called schizogony. In a few generations, and perhaps as the result of conditions unfavourable to development, certain merozoites grow in a different fashion, developing into gametocytes, male and female. These are the sexual forms of the parasites, but are sexually inert whilst in the human body. This process of schizogony and the production of gametocytes represents the whole gamut of development in the human body. Further development can only take place under normal conditions as the result of the intervention of the second host, which is the female of certain species of anopheline mosquitoes. In the course of a favourable chain of circumstances an infected individual with gametocytes in his peripheral circulation is bitten by such an insect, and the gametocytes are sucked up along with the blood on which the mosquito feeds. Very rapidly the gametocytes develop into gametes and become sexually potent. "Exflagellation" of the male occurs and the "flagellæ" or microgametes break free and proceed to fertilize the females or macrogametes. The impregnated gamete, now called the oocyte, migrates partially through the wall of the mosquito's stomach, and coming to rest in its muscular layer undergoes further development as the oocyst. This divides repeatedly, increasing in size until it finally ruptures and sets free in the lymph spaces of the mosquito large numbers of tiny sickle-shaped sporozoites. These migrate until the majority come to rest in the cells of the veneno-salivary glands, whence on the mosquito feeding they are injected, it may be, into a new human host, whose red cells they rapidly penetrate, thus giving rise to a fresh infection.

The point of epidemiological importance which emerges from this is

that the disease cannot pass from an infected to a healthy individual except through the medium of certain mosquitoes (and of course excepting artificial experimental methods such as the injection of infected blood).

GENERAL PRINCIPLES OF PROPHYLAXIS.

In considering the prevention of malaria the first principle which presents itself is that of avoiding malarious countries during the season of prevalence of that disease. This is only common sense, yet history shows how often the principle has been thoughtlessly violated. As a single instance, the ill-fated Walcheren Expedition took place during the most malarious part of the year, and this despite the fact that Sir John Pringle in 1765 wrote a specific warning with regard to this locality at this particular time [4]. On the other hand the Ashanti campaign of 1873-74 was conducted with a minimum of illness by paying due regard to this principle [5].

It is not as clearly realized as it might be that the season in which primary malaria is liable to occur is very well defined. A certain amount of confusion arises from the old term "spring fever," by which what is now known as the benign tertian type was designated. In countries where malaria is endemic (particularly sub-tropical countries) there is admittedly a very noticeable epidemic in the months of April and May, but these cases in an overwhelming if not an absolute majority are relapses and not primary cases. Real primary cases do not occur until June. This was clearly shown during the Great War, where it was possible to watch the onset in large numbers of hitherto uninfected men. In Salonica in 1916 there were in all fifty cases during the first five months, many of which were probable relapses from infection contracted in India and elsewhere [6]. In June there were ninety cases, and from then until the end of the year over 30,000. In the light of after-knowledge regarding the breeding of *Anopheles superpictus* in the hill streams it seems reasonable to conclude that the advance into the Struma Valley which took place about the beginning of the epidemic was more of a coincidence than a causative factor.

In the early months of 1917 relapses were frequent among the old divisions (in the first five months admissions to hospital were over 8,000 as compared with fifty of 1916), but in a new division which came to the country in December, 1916, primary cases did not occur until June, as shown by the results of the blood examinations made at the casualty clearing station clearing this division. This observation was controlled as carefully as active service conditions would permit, and was very striking [7].

A similar state of affairs prevailed in Palestine, as observed by Manson Bahr, who states that there were no fresh infections before the first week in June [8].

In the Panama Canal campaign no direct observations on this point can be traced, but the graph of admissions to hospital shows a vast increase

in the number of cases from June onwards each year, which is in keeping with the theory [9].

In Bombay, Bentley [10] in a series of dissections of mosquitoes carried out over eighteen months found no infected mosquitoes between November and June, but many in the months between June and November. In tropical countries the rainy season plays a large part by encouraging mosquito-breeding, but the months of prevalence are the same as in sub-tropical countries.

It is less easy to determine the end of the malaria season, but the old observation that it goes with the onset of the frosts, or in other words about the middle of November, is accurate enough for practical purposes.

It can therefore be assumed that from the end of November till the beginning of June malarial regions in the northern hemisphere can be inhabited with relative impunity, and where short campaigns are anticipated, other things being equal, this season of the year should be utilized.

In the southern hemisphere where the seasons are reversed, the malaria season occurs at the corresponding time of the year, and calculations should be made accordingly. The majority of cases occur in the first four months of the year. In any case there is little difficulty in ascertaining by inquiry when the season of prevalence occurs.

Another principle along similar lines with a limited application in tropical warfare is to replace European troops wherever possible by native troops who have acquired natural immunity. Such immunity occurs in natives of malarious regions largely through a process of survival of the fittest [11]. From infancy they are infected with the parasite, and suffer from recurring attacks of malaria of which many die. In those who survive the attacks in course of time become modified and ultimately more or less disappear, although in most cases parasites are to be found. Such individuals are not liable to suffer from attacks of fever when placed in an environment where much primary malaria is occurring.

European soldiers sent to malarious countries should wherever possible be seasoned troops who have been well grounded in sanitary discipline, and know the value of taking care of themselves. Men harbouring parasites or with a history of recent malaria should be eliminated from the force, as they are liable to act as sources of infection, and under favourable circumstances may be the starting point of an epidemic.

A further general principle is that all plans should be made and precautions taken in advance of a campaign. If the disease is once allowed to take a hold it is infinitely more difficult to eradicate, whereas if it is anticipated and the necessary machinery is provided, the combating of it may be a relatively simple matter.

ACTIVE PRINCIPLES OF PROPHYLAXIS.

Throughout all these previous principles runs the proviso: "if the exigencies of service permit," and to the student of history it will be clear that sooner or later the exigencies of service will *not* permit, and an

army of unseasoned soldiers will be forced to serve in a malarious country during the season of prevalence, just as in India and other stations in peace time our troops have in many cases to pass the malaria season in stations which in the absence of prophylactic measures would certainly be malarious. It therefore falls to be considered how the disease can be fought in its chosen environment, and here it is that a knowledge of the life history of the parasite is essential. By studying this it can be seen that there are four main groups of methods by which the disease can be attacked: the first, by reducing, and if possible eliminating, the reservoir of infection: the second, by destroying in their developmental stage the anopheline mosquitoes which carry the disease: the third, by protecting healthy individuals from the bite of infected mosquitoes: and the fourth, by endeavouring through the use of prophylactic quinine to prevent infection occurring even when an infected mosquito has bitten.

Let us consider these methods *seriatim*, both as regards their general application, and with special reference to active service conditions. It stands to reason that many methods favourable in peace would be mere waste of money in war; for while in the former the scope of the operations is limited only by the question of finance, in the latter it is hampered by many circumstances, such as the constant movements of troops, the large area of country involved, the difficulty in procuring labour, and by no means least the limitation of activity imposed by the enemy. There is little doubt that on active service methods which apply to the individual, which can be taught to the individual, which can at all times be applied by the individual, and for which each individual can be held responsible, are most likely to be successful. Furthermore it is generally agreed as pointed out by James that "practical experience is to the effect that it is usually best to concentrate all available effort on one carefully selected method which can then be brought to a high degree of perfection" [12].

THE ELIMINATION OF THE RESERVOIR OF INFECTION.

The elimination of the reservoir of infection is a method which theoretically sounds very attractive but practically does not offer very much help.

It may be attempted by segregation of infected individuals, keeping them apart from healthy people a distance greater than the flight of the mosquito, so that mosquitoes which become infected through sucking their blood will not travel far enough to be able to infect the healthy people. This is a principle applicable to the natives of malarious regions, most of whom harbour the parasite; these should be kept away from camps and cantonments during the hours that anophelines feed, or roughly from dusk till dawn. It used to be stated that the distance a mosquito wandered from its breeding place rarely exceeded half a mile, but Wenyon has shown that given a gentle breeze the flight may often exceed a mile, and may even be two or three miles [13]. To enforce absolutely effective segregation is therefore impracticable, and in a country with a scattered population is next to impossible. Nevertheless as by the law of "Random Scatter" [14],

it is obvious that there will be a greater concentration of infected mosquitoes in the vicinity of the sleeping places of natives, these should be given as wide a berth as possible. If active service conditions render necessary a more or less permanent post near a native village, it may be advisable to evict the natives to temporary quarters at a safe distance.

Of much greater importance are steps taken to prevent infected troops or Europeans in a community from acting as sources of infection. Segregation at a distance is totally unsuited here, but there need be no danger if patients are effectively treated with quinine and protected from the bites of mosquitoes. It is a notorious fact among microscopists that in most cases even relatively small doses of quinine will drive the majority of parasites from the peripheral circulation, and by taking advantage of this fact and administering regular doses of quinine to an infected individual he can very frequently be rendered of no danger to his comrades. Even if the reduction of gametocytes in the peripheral circulation is only relative and not absolute this will greatly reduce the numbers of mosquitoes becoming infected, as it has been calculated that blood containing fewer than twelve gametocytes per cubic millimetre is non-infective [15]. In other words vigorous and efficient treatment is in this sense an excellent prophylactic. Opinions vary as to the most suitable course of after-treatment in malaria. Ross [16] strongly recommends a prolonged course of ten grains of bisulphate of quinine in solution to be taken immediately before breakfast each morning. Others have got better results by giving thirty grains on each of two consecutive days in a week, say Saturday and Sunday. Others again give thirty grains on one day only per week. In actual practice either of the first two methods will give good results provided it is conscientiously carried out. The cause of most failures lies with the patient who fails to keep to the prescribed course. For this reason in the services at least the second alternative is often to be preferred, as it reduces the amount of supervision required to ensure that the treatment is carried out. Conversely the patient is more apt to be inconvenienced by occasional doses of thirty grains than by regular doses of ten grains per diem. The course must be persisted in for at least two months, preferably longer. Good results have been obtained by giving the men undergoing this course double rations, light duty, and graduated exercise in the form of route marches [17]. Tonics containing iron and arsenic play a useful part in some cases.

It goes without saying that such treatment should be coupled with efficient screening, the exact method of which will be detailed in a later section.

These precautions are especially important where troops are remaining in one place for any length of time, as a mosquito infected by neglect of these measures is liable to remain in the vicinity, and, when the parasite has sufficiently developed, may possibly be the cause of many new infections.

(To be continued.)

SECONDARY WOUND SHOCK: ITS CAUSATION, PREVENTION AND TREATMENT.

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(Continued from p. 13.)

PREVENTION AND TREATMENT OF SECONDARY SHOCK.

EVERY effort should be made to prevent the occurrence of secondary shock, and where it has already developed to prevent its further aggravation.

It is proposed to deal with this part of the subject in three sections, viz. :—

(a) Discussion of the various measures employed in the prevention and treatment of this condition.

(b) Discussion of the treatment of definite clinical types of shock.

(c) Discussion of the application of the foregoing measures to military surgery in time of war.

(a) Discussion of the Various Measures employed in Prevention and Treatment.

(1) *Warmth.*—It has already been pointed out that cold is one of the most important factors in the production of shock. It is, therefore, of the utmost importance that all patients who have developed or are likely to develop shock should be thoroughly warmed and that every effort be made to prevent their subsequent chilling. At the same time care must be taken that patients are not overwarmed to such an extent as to cause sweating and discomfort which may produce exhaustion. The body heat may be raised by the various methods of rechauffement described later, by hot drinks, and by infusions given at a temperature above the normal body temperature [34].

(2) *Relief of Pain.*—As pain tends to produce and aggravate shock, everything that is possible should be done to prevent and relieve it. Wounds should be carefully dressed and fractures splinted as soon as possible after injuries have been received. Morphia in moderate doses is beneficial and should be given when required. Large doses of morphia are harmful and the drug should never be given to patients who are cyanosed.

(3) *Prevention and Relief of Mental Anxiety.*—It has been shown that emotional stimuli tend to produce shock. Patients should therefore be kept quiet and subjected to as little disturbance as is consistent with proper treatment.

(4) *Arrest of Hæmorrhage.*—The relation of hæmorrhage to shock has already been discussed.

(5) *Prevention of the absorption of Disintegrated Tissue Products.*—This is done by the efficient splinting of compound fractures, by the careful transport of injured individuals, by the excision of crushed tissue and by the early amputation of hopelessly smashed limbs. The question of operations will be fully discussed later.

(6) *Relief of Thirst.*—This can be done by the administration of fluid by the mouth or rectum. It may also be given subcutaneously or intravenously, but the former methods are preferable, where the condition of the patient admits of their being carried out. Fluid given by the mouth should be hot and some have advised the addition of a little potassium citrate or sodium bicarbonate, with a view to keeping the acidosis within bounds.

(7) *Prevention of Vomiting.*—Persistent vomiting does harm by depleting the body of fluid and must therefore be prevented as far as possible. In some cases the administration of hot drinks will produce or aggravate vomiting. With a view to preventing this Gray [32] has recommended that hot drinks be given in small quantities at a time, after the patient has been warmed and when all disturbances, such as the dressing of wounds, have ceased. Where vomiting is severe and persistent, such as is seen in abdominal cases, it may be necessary to pass a tube and wash out the stomach.

(8) *The question of Stimulants.*—The majority of stimulants are looked upon as being harmful. Alcohol in small doses is recommended by Doyen (France) [32], but it is not usually employed in this country.

Strychnine has been experimentally shown to be harmful and produces in a normal animal cell changes similar to those found in shock (Crile) [8]. Vasoconstrictors such as adrenalin are bad. They act by producing arterial constriction, which causes a temporary rise in blood-pressure or delays its fall, but which at the same time tends to cut off the blood in the capillaries from what driving force the already depleted heart can supply.

Pituitary extract is probably useless, unless in cases where intestinal paresis is present, when it is thought by some to do good.

Camphor in olive oil given hypodermically appears to be useful at times. Digitalin is useful when the heart becomes embarrassed.

(9) *Administration of Intravenous Infusions.*—These are given with a view to increasing the blood volume and raising the blood-pressure. Various solutions have been used, but in all of them, with the exception of gum solution, the effect is only transient, as the fluid quickly escapes from the blood-vessels into the tissues.

The following solutions have been used:—

(a) *Normal Saline* (0.9 per cent sodium chloride) has a definite but small and transient effect. It is practically useless as a method of raising and maintaining blood-pressure. It is better when given by the rectum as it is then retained longer in the system and utilized to a much greater extent and does not tend to produce water-logging of the tissues.

(b) *Ringer's solution*, which contains sodium chloride 0.9 per cent, potassium chloride 0.03 per cent, calcium chloride 0.02 per cent, and a trace of sodium carbonate, has been used and gives results which are much the same as normal saline.

(c) *Hypertonic saline solution*, which contains sodium chloride, 2 grammes; potassium chloride, 0.05 gramme; calcium chloride, 0.05 gramme, and water, 100 cubic centimetres, has been used, and gives slightly better results. The benefit, however, is only temporary, and the resulting rise of blood-pressure is not maintained more than two hours at the most, and usually much less. It is useful at times to tide a patient through an operation. The use of this solution is based on an effort to increase the salt content of the blood, and thereby prevent a loss of fluid from the blood-vessels by osmosis. The salts rapidly diffuse through the vessel walls, and in a short time the salt content of the blood becomes reduced, so that the effect becomes the same as if an infusion of saline had been given.

(d) *Gum acacia solution of Bayliss* [33].—This contains 6 per cent gum acacia and 0.9 per cent sodium chloride. Originally 1.5 per cent sodium bicarbonate was used instead of sodium chloride. The solution is prepared by adding hot boiled tap water to the gum and salt, in small quantities at a time. A precipitate forms, which is got rid of by filtration. If the solution is now sterilized in well stoppered bottles (the stopper being loose during sterilization) it will keep for long periods. This solution gives much better results than any of the others. It raises and maintains the blood-pressure. The rationale of its use is that it is a colloid solution which has a viscosity approximately the same as the blood, and an osmotic pressure the same as the plasma, and therefore when introduced into the circulation in sufficient quantity, not only raises but will maintain the blood volume and blood-pressure by preventing a loss of fluid from the blood-vessels to the tissues. To the casual observer it does not produce the same immediate dramatic effect, which is frequently observed when blood is transfused. McNee, Sladden and others [34] have reported that they have seen no case respond to blood transfusion that failed to do so to gum solution. When shock is complicated by severe hæmorrhage the results got from gum are not so good as from blood transfusion, and undoubtedly in dealing with cases of profound shock, the latter treatment is the one to be adopted. Bayliss has pointed out that whereas the first infusion of gum solution has sometimes little effect, if it is repeated in half an hour or so marked improvement often results. It is also of great importance that the infusion should be given as early as possible after the onset of shock.

(e) *Gelatine solution* in a strength of six per cent has a viscosity equal to that of the blood, and an osmotic pressure equal to that of the blood colloids if it is not heated above 40° C., and will raise and maintain the blood-pressure in the same manner as gum acacia solution [33]. On the other hand, if it is heated above 40° C., it loses the greater part of its viscosity (Bayliss). It is not suitable as an intravenous infusion, as it is

necessary to heat it for some time to 100° C. to deprive it of the power of setting on cooling, and moreover it is also necessary to sterilize it thoroughly on account of the presence in it of tetanus spores [33].

(f) *Dextrin solutions*, in strengths varying from two and a half per cent to eight per cent have been used, but do not maintain the blood-pressure for long [33].

(g) *Four per cent solution of sodium bicarbonate* has been recommended on account of the acidosis which is usually present. It has now been given up in accordance with the more recent views on the effects of acidosis, and moreover acidosis disappears when the blood-pressure is raised to normal [35].

These solutions are given at body temperature. The usual amount to administer is one pint, and this should take twenty minutes to run into the vein. Bayliss recommends that the amount of gum solution given should be 750 cubic centimetres [33].

To recapitulate, both isotonic and hypertonic saline infusions are almost useless, as the rise in blood-pressure and increase in blood volume, which they cause, are only transitory. Of the two the hypertonic solution is the better, and may be of use in the milder forms of shock, or in cases where nothing else is available. Gum solution is the only solution other than blood which is of real use in raising and maintaining the blood-pressure. When given it must be given early, and should be repeated in half an hour or so, if marked improvement has not taken place. In profound degrees of shock, and especially those complicated by severe hæmorrhage, it cannot really be looked upon as being as good as blood transfusion, although its beneficial effects are beyond all doubt.

(10) *Blood Transfusion*.—The enormous value of this method of treatment lies in the fact that it is the only means available of increasing the oxygen-carrying power of the blood and thereby supplying oxygen to the starved tissue cells. The most striking results have been obtained in those cases of profound shock where hæmorrhage has played some part. Where transfusion is carried out in this type of case the following changes are usually observed within a very short time:—

- (i) Marked improvement in the patient's general condition.
- (ii) Strengthening of the pulse and slowing of its rate.
- (iii) Marked rise in the blood-pressure. This may become apparent before the transfusion is finished.
- (iv) Increase in the hæmoglobin and red cell counts.

The immediate effect of blood transfusion is at times little short of miraculous. Cases were often seen during the late war which without a preliminary transfusion would have been inoperable, and again after operation many cases would undoubtedly have died had it not been for a timely blood transfusion. It is a form of treatment to be recommended for cases of very severe shock, but more especially for those in which there has been hæmorrhage.

The drawback to blood transfusion, where large numbers of cases have to be dealt with, as in time of war, is the difficulty of obtaining a sufficient supply of blood donors belonging to the right blood groups. A blood donor must be healthy and free from syphilis and malaria, and a preliminary test must be carried out to make certain that his corpuscles are not hæmolyzed or agglutinated by the patient's serum.

The amount of blood usually given is 500 cubic centimetres.

The dangers of transfusion and the technique of the various methods which may be employed, are fully described in the Vol. I, "Surgery," History of the War, Medical Services. It will here be sufficient to state that from the point of view of military surgery, by far the best and safest method is that which is known by the name of "The Citrate Method." The best apparatus to use is that recommended by Robertson. The principle of the method is that 500 cubic centimetres of blood from a suitable donor are drawn into a bottle containing 160 cubic centimetres of a 3·8 per cent solution of sodium citrate, which has been previously sterilized. The blood and the citrate solution are thoroughly mixed to prevent clotting of the former. A transfusion needle, which is connected by a tube to the bottle, is inserted into the recipient's vein and through this the citrated blood is slowly forced by producing a slight positive pressure in the bottle by means of the bulb of an Ingram's syringe.

Another method which has given satisfactory results is "The Preserved Corpuscles Method." Five hundred cubic centimetres of blood from a universal donor are drawn into a bottle containing a solution of glucose and sodium citrate and placed in an ice-chest for four or five days. The supernatant fluid is then syphoned off and the corpuscles stored on ice till required. They will keep for about three weeks and when required for use are made up to 1,000 cubic centimetres with saline and filtered through layers of gauze. The advantage of this latter method is that the blood can be collected and prepared beforehand, when it is anticipated that there will be a large number of cases to deal with such as was seen at casualty clearing stations during the late war.

(11) *The Question of Anæsthetics.*—Chloroform is dangerous. Ether is also bad. Ether does not affect the blood-pressure during the operation, but afterwards a fall becomes apparent. This is thought to be due to a toxic action on the endothelial lining of the blood-vessels which renders it permeable to the blood fluids [36].

Nitrous oxide and oxygen is the best anæsthetic to use, as it does not cause a post-operative fall of blood-pressure [37]. Cannon [38] has pointed out that the reserve alkalinity of the blood is kept up better under this than under ether. Spinal anæsthesia is said to be bad on account of it causing a fall in blood-pressure. This however is not very noticeable if it is combined with very light ether anæsthesia. Deplas (France) [32] strongly urges the use of spinal anæsthesia in dealing with injuries of the lower extremities. He recommends that it should be preceded by an injection

of morphia and combined with oxygen inhalations. Local anæsthesia is good but it is not always possible to use it.

(12) *The Question of Operations*.—It has been observed that operative interference has a bad effect on patients suffering from or on the borderline of shock. It is probable that many of the bad effects are attributable to the anæsthetic.

Often the symptoms of shock, which have not developed when the operation is commenced, become apparent in the course of the operation or after it is over. It is also well known that certain types of operations tend to produce secondary shock in individuals who have not met with any injury before the operation. Cannon [38] has shown that the following post-operative changes take place: (1) A fall of blood-pressure; (2) a reduction of the reserve alkali of the blood; and (3) an increase in the concentration of the blood. Apart from the original injury, there are certain factors which appear to influence the production of post-operative shock. These are: (1) The effect of the anæsthetic; (2) the previous condition of the patient—a patient who has been the subject of hæmorrhage or sepsis is more apt to develop shock; (3) the length of the operation—a long operation is more likely to be followed by shock; (4) the nature of the operation—those during which the tissues are traumatized, where there is much loss of blood, where large masses of muscle are cut across such as in amputations, and where there is much handling of intestines and dragging upon peritoneum, are liable to be followed by shock. Where possible, it is advisable to postpone operation in cases with a low blood-pressure and other signs of impending shock until such time as some recovery has taken place. In dealing with a severely wounded man with a low blood-pressure, the surgeon is often called upon to choose the lesser of two evils—an operation where the risk is serious on account of the aggravation of the shock already present, and a delay during which serious or even fatal toxæmia may develop. No hard and fast rules can be laid down and each case must be decided on its merits. The question of the absorption of the toxic products of damaged muscle and the increase of sepsis must always be borne in mind in postponing an operation on a wounded man. In this connexion, experience has shown that the early amputation of a hopelessly smashed limb is distinctly beneficial to the patient, as it is followed by a lessening of shock. In deciding when to operate, Gray [32] considers that the systolic blood-pressure is an important indication of the patient's condition. He believes that if it is not below eighty-five millimetres Hg an operation may be proceeded with, provided that the right anæsthetic is chosen and the operation rapidly performed. If it is decided that an operation is imperative, there are certain prophylactic measures which ought to be carried out—viz:—

(i) If the blood-pressure is low, it should be raised by the infusion of gum acacia solution or the transfusion of blood.

(ii) The patient should be thoroughly warmed and kept as warm as possible during the operation.

(iii) The anæsthetic, if possible, should be nitrous oxide and oxygen.

(iv) The operation should be carried out as quickly as is consistent with thoroughness. Traumatization of tissues should be reduced to a minimum and any separation or severance should be performed with a sharp knife. Intestines when exposed should be carefully covered with sterile towels wrung out of hot saline, and should be handled as little as possible. Bleeding points should be carefully secured and any unnecessary loss of blood avoided. Crile recommends that in amputations, nerves should be blocked with novocain before being divided. He also recommends that the skin and tissues in the line of all incisions, and the peritoneum in abdominal operations, should be infiltrated with $\frac{1}{4}$ per cent novocain solution. The idea is that painful stimuli, caused by the operation, are thereby prevented from reaching the sensory cells of the brain and producing or aggravating shock. Strong evidence against this theory of shock production has already been quoted. Nevertheless the procedure is mentioned as there is still a number of surgeons who carry it out, in the belief that it considerably lessens post-operative shock. In cases where there is no infection, Crile advises the use of the bihydrochloride of quinine and urea ($\frac{1}{8}$ per cent to $\frac{1}{2}$ per cent solution), which is injected some distance from the line of the incision, instead of novocain. The anæsthetic effect of this drug lasts several days and considerably lessens post-operative pain.

When the operation has been finished, treatment should be carried out along the lines indicated in the earlier part of this section. Warmth should be maintained, fluids given by the mouth and rectum, pain relieved and sleep encouraged by the use of morphia. After intestinal operations it is well when giving morphia to combine with it atropine sulphate $\frac{1}{160}$ grain, as this helps to prevent painful distension. If much blood has been lost and if the general condition is bad and the blood-pressure falling, an infusion of gum solution should be given or blood transfusion carried out. The use of stimulants should be avoided except where the heart is embarrassed, and then digitalin $\frac{1}{160}$ grain may be given hypodermically.

(b) Discussion of the Treatment of Definite Clinical Types of Shock.

There are three main phenomena of shock towards the relief of which treatment should be directed. These are :—

- (1) Loss of body heat.
- (2) Fall of blood-pressure.
- (3) Diminution of blood volume.

As has already been pointed out, the last two are dependent on one another.

An individual's power of recovery from shock depends to a great extent on the power of his circulation to take up fluid from the tissues and thereby increase the volume of his blood and diminish its concentration, or to retain fluid which is added for this purpose [36].

It has been shown experimentally that when the circulation of the blood is restored to normal, toxins of the "histamine type" are quickly got rid of from the system.

It has been found that cases of shock may be divided, clinically, into three groups [39], viz :—

Group I: Compensated Cases.—In this group the patient has the power to take up fluid from the tissues and dilute his blood. The general condition of the patient is good. The pulse is 90 to 110. The systolic blood-pressure is above 100 millimetres Hg, and the blood volume is never below 80 per cent. The plasma volume does not show so great a reduction and is usually 85 to 90 per cent of normal.

Warmth and rest are usually sufficient for this type of case. Should the symptoms get worse after an operation, gum solution should be given intravenously and saline administered per rectum.

Group II: Partially Compensated Cases.—In this group the power to take up fluid from the tissues is feeble, but there is power to retain fluid introduced into the circulation. The general condition is poor and the extremities are cold. The pulse is 120 to 140.

The systolic blood-pressure is below 90 millimetres Hg and is usually 70 to 80 millimetres. The blood volume is 65 to 75 per cent, and the plasma volume 70 to 80 per cent of normal.

The treatment in the first place should be warmth and rectal salines. If there is no improvement after an hour, an intravenous infusion of gum solution should be given. If improvement, as indicated by the condition of the pulse and blood-pressure, is maintained for two or three hours, an operation may be undertaken if it is considered necessary. If, however, improvement is only transient, a second infusion of gum solution should be given. If there is no effect from this, blood transfusion should be carried out. Should the patient collapse during or after an operation, prior to which two infusions of gum solution have been given, blood transfusion should be carried out.

A good indication of the rate at which the blood is being diluted is the rate at which the hæmoglobin percentage falls. It is advisable to estimate the hæmoglobin before the first infusion is given and afterwards to carry out repeated estimations. Where fluid is not being retained in the circulation the hæmoglobin percentage does not fall to any appreciable extent.

Group III: Uncompensated Cases.—In these cases both the power of taking fluid from the tissues and the power of retaining it in the circulation are absent. The pulse is imperceptible. The systolic blood-pressure is below 60 millimetres Hg. The blood volume is below 65 per cent, and the plasma volume as low as 62 per cent of normal. In these cases treatment is, as a rule, of no avail. The treatment of this type of case should be warmth and early blood transfusion.

(c) *Discussion of the application of the Foregoing Measures to Military Surgery in Time of War.*

It will be readily understood that the varied conditions met with in warfare render it difficult to be able to maintain at all times a uniformly high standard of efficiency as far as the prevention and treatment of secondary shock are concerned.

Difficulties arise when there are large numbers of wounded to deal with, such as are seen when there is a big advance or retreat; when the weather is unfavourable and when the routes of evacuation are bad. Much has been written about what ought to be done for the wounded man at the regimental aid post, but the writers always seem to overlook the fact that during active operations the R.A.P. is often situated in a shell hole or by the side of a sunken road or in some similar place, where there is little opportunity of carrying out anything much in the way of treatment, and where detention of the patient will only serve to increase his bodily and mental discomfort. It must therefore be understood that the procedure about to be recommended cannot always be carried out in the forward area. An effort should, however, be made to do as much as circumstances will permit and what may have to be left undone at one post it may be possible to do at the next post further back along the line of evacuation. Since such factors as cold, pain, hæmorrhage, and toxins play such an important part in the production of secondary shock, efforts must constantly be directed towards reducing these to a minimum.

The enormous value of the lessons taught by the late war of the benefit derived from the warming of wounded men, from the establishment of advanced operating centres, "resuscitation rooms" and "shock-teams," can hardly be overestimated.

It is proposed to indicate the lines on which prevention and treatment of shock should be carried out at the various stages through which a man passes during evacuation from the front line.

(1) *Treatment by the Regimental Stretcher Bearers.*—All stretchers supplied to these bearers should have fastened to them a blanket, wrapped in a waterproof sheet, which serves to keep it dry. In addition to the ordinary equipment of dressings and tincture of iodine, each bearer should be supplied with a strong pair of scissors, which enables him to get at a wound by the shortest possible route. The necessity of keeping the patient warm and of applying the dressing quickly and efficiently, with as little exposure as possible, should be thoroughly impressed upon them. They should be carefully instructed how to control hæmorrhage, and how to improvise tourniquets. Personally, I found it inadvisable to encourage them to apply splints, as they usually wasted a lot of time putting them on, and they invariably had to be reapplied at the R.A.P. The only exception I made to this was the application of a rifle splint to a fractured lower limb. Needless to say, the necessity of getting patients back to the R.A.P. as quickly as possible should also be impressed upon them.

It is of great importance that wounded men should not be allowed to exert themselves any more than can be avoided. Where it is necessary for them to walk back to the R.A.P. they should be divested of all unnecessary equipment, so as to enable them to perform the journey with the least possible exertion.

(2) *Treatment at the Regimental Aid Post.*—A supply of dry blankets, stretchers, and hot water for the preparation of hot drinks should always be at hand. Where circumstances permit, an oil stove and a pair of trestles should form part of the equipment of the R.A.P.

When a severely wounded case arrives, he is transferred to a dry stretcher, on which have been placed two blankets folded lengthwise in such a way that a double thickness of each blanket, comprising two-thirds of its width, is underneath the patient, and the remaining third of each blanket hangs as a flap over either side of the stretcher. A third blanket is folded and placed on top of the patient, and the side flaps are turned over this. In this manner the maximum warmth can be obtained from three blankets. Wet clothes should not be removed unless they can be replaced by sufficient blankets to keep the patient warm. If an oil stove is available, it should be placed under the stretcher, which rests on trestles, and the side flaps turned down so as to form a hot-air chamber beneath the patient, which soon warms him. The dressing of the wounds should now be attended to and hæmorrhage controlled. Fractures should be carefully splinted and everything done to prevent aggravation of the wound during transport. Hot drinks of sweetened tea, coffee or cocoa should be given. Morphia, $\frac{1}{4}$ grain, should be administered if the patient is suffering any pain, and the fact noted on the medical card.

No operations should be undertaken anywhere in front of the casualty clearing station, except those necessary for the arrest of dangerous hæmorrhage, or perhaps for the removal of a hopelessly smashed limb, which by dragging on exposed nerves is causing pain and aggravating shock.

When a severely wounded man, exhibiting the early signs of shock, arrives at the R.A.P., the treatment of his general condition and not his wounds should be the primary consideration. Having made him warm and comfortable, the aim should be to get him evacuated as quickly as possible.

(3) *Treatment at the Advanced Dressing Station.*—The same treatment should be continued. Unless there is any special indication, the dressing should not be touched, but splints should be readjusted if necessary. As the next stage of the journey is usually by ambulance cars, care should be taken that the cars are properly warmed and in addition, hot water bottles, if available, should be used.

(4) *Treatment at the Main Dressing Station.*—The warming process should be continued and hot drinks given. Splints should be readjusted if necessary. The dressing, if comfortable and not soaked with blood, should not be touched, unless it is anticipated that there will be some delay

before the case can be got back to the casualty clearing station, in which case the wound can be cleaned up and a sterile dressing applied. Anti-tetanic serum should be given and morphia repeated if necessary, and the fact noted on the medical card. No operation other than those referred to should be undertaken.

The importance of good organization at the main dressing station whereby serious cases are singled out and dealt with without undue waste of time cannot be exaggerated. Having carried out the foregoing treatment, the main object should be to get the patient back to the casualty clearing station as quickly as possible.

Often, however, during active operations cases have to be kept for some time at the main dressing station owing to the difficulties which may be experienced by the motor ambulance convoys in coping with large numbers of wounded. In event of this happening, it would be well to administer intravenously 750 cubic centimetres of gum acacia solution to those patients who are suffering from severe degrees of shock. Conditions will not, of course, always permit of this being carried out, but often it will be possible to give at least a rectal saline.

Where possible each main dressing station should have a resuscitation room, where patients can be thoroughly warmed. The following are a few of the types of warming apparatus which can easily be improvised beforehand :—

(a) The type already referred to for use at a regimental aid post. The advantage of this form is that the warming process can be carried on whilst the patient is being examined and the dressings attended to.

(b) A type for use with the primus stove. This consists of an oil drum which is placed on the floor in the upright position. A window is cut in the side near the lower end, through which the stove can be introduced. A metal pipe fixed to the top of the drum conducts the hot air into a cradle which rests on the stretcher and is covered with blankets.

(c) A type for use with the tall pattern oil stove. This consists of an empty petrol tin which is laid with its broad surface flat on top of the oil stove. A hole is cut in the tin where it is in contact with the stove, and a pipe let into one end of it conducts the hot air into a cradle on the stretcher.

As already mentioned, care must be taken that the patient is not over-heated.

If piping is not available it can be improvised from the sides of biscuit tins.

Cradles can be improvised from strips of aluminium splinting or by using several suspension bars, such as are employed with the Thomas splint.

(5) *Treatment at the Casualty Clearing Station.*—At the casualty clearing station it is essential that the whole staff be so organized that there is no unnecessary waste of time in singling out those patients who urgently require treatment.

Each casualty clearing station should have a resuscitation ward, fitted up with various forms of hot air, and where possible electric warming, apparatus. There should be "shock teams" whose duty it is to look after the more severe cases and to attend to the administration of infusions and transfusions. A list of blood donors, whose groups have been ascertained and recorded, should be kept; needless to say this list should contain as many universal donors as possible. A supply of bottles containing citrate solution and the other parts of the Robertson apparatus should be kept sterilized and ready for use. It would also be well to have at hand quantities of preserved corpuscles for use when large numbers of wounded are expected. Quantities of gum solution, sterilized and ready for administration, should also be at hand. When a severely wounded man is admitted, the warming process should be begun as soon as possible and carried on concurrently with the removal of his clothes and the examination of his wounds.

It is at the casualty clearing station that all the methods of treatment discussed in the previous sections can usually be fully put into practice, and every possible effort should be made to deal with cases along these lines as far as time and circumstances will permit.

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RADIOLOGY (IN ARDUIS FIDELIS).

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(Continued from p. 358, Vol. XLII.)

IV.—M.M.R. PHOTOGRAPHY.

THE necessity for careful technique in the dark room is obvious, when one considers that probably seventy-five per cent of bad radiograms are due to lack of care and knowledge in photographic procedures.

In order to help those who have difficulty in finding collated statements and explanations pertaining to photography the following notes have been compiled.

The definitions will be of value, not only to radiologists and radiographers, but also, it is hoped, to those interested in amateur photography.

Photographic technique does not differ materially in peace or in war, except that in the latter, the improvisation of a safe and suitable dark room is generally necessary.

In temperate climates, one of the main difficulties is to keep the temperature of the developer up to 65° F., while in the tropics, considerable ingenuity has to be exercised to keep the developer down to that temperature.

It must always be remembered that in ordinary photography lenses are used, while in radiography the exposure is only a shadow projection, in fact "shadow-graphy".

These notes fulfil and cover the requirements of the synopsis of study for the various radiographic and radiological examinations in photography, and after perusal might well be passed on to any N.C.Os. or men employed on this class of work.

DEFINITIONS.

Absolute Zero.—It has been assumed that at minus 273° C., or at minus 459° F., heat would be entirely absent, and no further cooling would be possible. This is, therefore, the lowest point of temperature, and a temperature described at present as 75° C. should be described, literally, as 75° plus 273° = 348° C.

Accelerator.—Any substance which shortens the duration of development and accentuates the impression of the slightest impact of actinic light or X-rays, is known as an "accelerator." In most modern developing solutions the accelerator is an alkali.

Achromatic.—A lens which projects images unaccompanied by coloured fringes is achromatic.

Actinic Light.—This is that portion of light which effects chemical change in distinction to those portions which furnish light and heat.

The dark room illumination should be of a non-actinic nature.

Air-bubbles.—These may be found in the emulsion as a rare defect in the manufacture.

Anastigmatic Lens.—A lens which focuses every point of the object accurately on to a corresponding point on the plate.

Blisters.—Any detachment of the gelatine film from the plate or celluloid, and is commonly due to material change in the density of the fluid to which the film is transferred, such as from a hot to a cold solution, or from a dense hyposulphite solution to water.

Brilliancy.—This is a term applied to a negative in which the lights and shadows harmonize, each having their proportionate amount of deposit, but without "fog."

Clearing Bath.—Any solution used to clear or cleanse a negative or positive from the stains of development is called a clearing bath. The clearing bath in common use is: alum, two ounces; citric acid, one ounce; water, twenty ounces.

Contrast.—The term contrast is used to signify that the adjustment of light and shade is such that they give due emphasis the one to the other, e.g., a negative possessing extreme contrast would be termed harsh or hard on account of the great difference existing between clarity and maximum density in the image. In radiography this is frequently a desirable result.

Definition.—That is accurate concentration of one point in an object to a corresponding point in the image or shadow on a sensitive plate or film.

Density.—This is opacity, and should be just sufficient to give due relation to the shadows and yet allow of good detail. Density is the value of the deposit of metallic silver.

Detail.—Sharp definition of minute markings or parts of the subject on the negative causes "detail."

Development.—The production of a visible picture from an invisible or latent impression is the definition of "development." This requires a chemical action, in which metallic particles of silver are deposited to form the image.

Distortion.—In photography distortion of perspective is usually due to lack of compensating accommodation in the lens system or to inaccurate placing of the subject or the camera.

In radiography it is due to incorrect positioning of the subject, incorrect positioning of the tube, and to lack of contact between the subject and the film.

Emulsion.—A mechanical mixture of any sensitive salt of silver in extremely minute division, usually silver bromide with a little silver iodide, held in suspension in any viscid vehicle, such as collodion or gelatine, which when spread on any transparent medium, shall present a homogeneous appearance when viewed by transmitted light.

Exposure.—The act of placing any sensitive surface under the action of actinic light or X-rays constitutes an "exposure."

Fading.—The negative gradually fades in time if insufficiently washed or fixed. The hyposulphite of soda continues to act on the delicate silver image.

Film.—The correct definition of film is “the layer of sensitive material on glass or celluloid, consisting of an emulsion of silver salts in gelatine or collodion, in which chemical action occurs after exposure to actinic light or the X-rays with the production of an invisible image.”

Colloquially “film” is used to describe celluloid coated with sensitive emulsion as opposed to glass similarly coated. X-ray films differ from ordinary films in that the thickness of the emulsion is practically identical, but the concentration of silver bromide in the former is higher, and this makes for better contrast. The X-ray films are also non-orthochromatic, i.e., non-sensitive to colour. This also applies to X-ray plates. To remove old films from glass or celluloid, soak them in soda and water overnight, and wash off with warm or hot water next morning.

Fixation.—The removal from an exposed film of any sensitive salt unacted upon by actinic light or X-rays, or by the chemical action of the developer, is “fixation.” The negative or positive thus treated becomes unalterable by further action of light or X-rays.

Flatness.—This term is used to describe a want of vigour or contrast in a negative due to over-exposure, or to the use of too strong or too weak a developer. Flatness can also arise from excessive penetration and scattered radiation.

Fog.—Fog is a universal or localized increase in the density of the plate produced by extraneous causes obliterating the natural lights and shadows. There are two causes of fog, “chemical” and “actinic.”

Chemical Fog :—

- (1) Error in original emulsion (rare) ; this may be “too much silver” or “a decomposed gelatine.”
- (2) Too strong a developer.
- (3) Old and stale developer.
- (4) Imperfectly mixed developer.
- (5) Imperfect fixation.
- (6) Stale “fixer.” The reaction of the fixer should always be acid.
- (7) Omitting to wash the film in water when transferring from the developer to the fixing bath causes “dichroic fog,” which is red by transmitted light and green by reflected light.

Actinic Fog (Ordinary and X-rays). Ordinary light :—

- (1) Faulty envelopes.
- (2) Storing films in too bright a light.
- (3) Leaky dark room.
- (4) Wrong colour of dark room light.
- (5) Holding film too near the ruby light.
- (6) Leaky cassette.

X-rays :—

- (1) Accidental, e.g., carrying in cassette while another case is being radiographed.
- (2) Secondary radiations,
 - (a) Scattered from the tissues or even off a wooden table.

- (b) Characteristic, i.e., characteristic for the metal or substance through which the X-rays pass, e.g., diaphragms of brass, iron, or nickel will cause trouble, whereas the radiations from aluminium will be absorbed by the container or paper envelopes in which the film lies.

(3) Leakage from the "tube room." This may occur, not only when the room adjoins, but sometimes if the room is in the same house and insufficiently protected, i.e., "faulty storage."

Additional protection should be adopted in the case of films loaded between two intensifying screens, as under such conditions the film is approximately ten times more sensitive to stray X-radiations than when lying in its own cardboard box.

- (4) Grossly pitted focus point on the anti-kathode target.

Frilling.—This term indicates that the emulsion leaves the plate or films in folds or wrinkles, and chiefly arises during fixing, and is due to—

- (a) Faulty original emulsion.
- (b) Unequal drying, i.e., at varying temperatures.
- (c) Hot solutions.
- (d) Too strong a force of water.
- (e) Too strong or too alkaline a developer.

(f) Varying densities of solutions, through which the negative passes—commonly the varying temperatures.

Halation.—This is blurring of the image, high-lights encroach on the shadows, due to the reflection from the back of the glass of the plate. This is practically non-existent with films and in radiography.

High-Lights.—The high-lights are the most "acted-upon" parts of the sensitive plate or film, and are represented in the negative by the greatest density or opacity.

In photography the high-lights represent such parts as the face in portraits and the sky in landscapes.

In radiography the high-lights represent those parts in the subject least obstructive (i.e., radio-parent to the X-rays), and hence represented in the negative by density or opacity, such parts as the lung fields in a radiogram of the thorax.

Image Latent.—Once the sensitive film has been exposed to the action of actinic light or the X-rays, the silver salts are transformed into "silver photo-salts," but nothing will appear until development is carried out, i.e., the image is latent.

Intensification.—This is the process of increasing the density of a negative by special chemical action.

Negative.—The negative is the image on a sensitive plate or film in which the natural lights and shades are reversed. In radiography the term is used for the developed film or plate, in which those parts of the subject of greatest atomic weight, density, or radiopacity appear most transparent, and those parts of least atomic weight and greatest radiopacity appear most opaque.

Photography.—"The art of obtaining the representation of objects by the agency of light, etc., upon sensitive substances."

Perspective.—"The representation of solid bodies on a plane surface."

Plate.—A photographic glass plate coated with sensitive emulsion upon which exposure is made for the production of negatives.

Pellicle.—The pellicle is the name given to the emulsion on the glass or film during manufacture.

P.O.P.—"Printing out papers." They are distinguished from those papers in which the image has to be developed after exposure.

Positive.—A positive is a reproduction of any object in which the lights and shades are represented as seen in nature. In radiography the positive is either a paper print made by contact off a negative, or may be a lantern slide made from a negative by reduction. The radiopaque parts of the subject will appear dark.

Preservative.—This is any particular chemical used in developing or other solutions to preserve them from too rapid oxidation.

Reduction.—This is the decreasing of the density of a negative or a positive by special chemical action.

Reduction.—The reverse process to enlarging, e.g. making lantern slides from large negatives.

Restrainer.—The restrainer is any substance used to prevent a too energetic action of the developer or reducer upon the exposed film.

Skin, Effect of Chemicals on.—Rubber gloves or finger stalls will prevent stained fingers. In the various photographic processes the hands should be kept as dry as possible, and should be washed frequently when they come in contact with chemical solutions.

"Pyro" stains are due to stale developer, and can be prevented by frequently rinsing the hands in a solution of citric acid, one drachm to four ounces of water.

"Silver nitrate" stains can be removed with a solution of chloride of lime, one ounce; sulphate of soda, two ounces; water, to twenty ounces.

"Nitric acid" stains should be treated by first applying potassium permanganate, and then washing hands thoroughly.

"Metol" causes severe cracks and sores in some persons; in such the use of this chemical should be abandoned for a time until treatment by ointments has effected a cure; when they return to work with the chemical they should pay particular care to frequent washing of the hands during the process of development.

"Bichromate" stains can only be avoided by the use of rubber gloves. The stains can be removed by dilute ammonia.

Stains and Markings on Negatives.—"Pin-holes" are tiny clear spots on the negative and may be due to:

(1) Faults in the original emulsion (rare).

(2) Dust on the film before exposure, often due to dusty intensifying screens.

(3) Dust or air bubbles on the film before and in the developer, such dust, particles, or bubbles act by preventing the normal action of the developer.

(4) Particles adhering to the film in the process of drying, especially chemical particles, e.g., sulphuric acid particles from charging cells near by.

"Drying marks" are caused by drying any two parts of the negative at different temperature conditions.

A line will show round the area which dried last, the films thus affected should be soaked in water at 65° F. for one hour.

"Spirit drying marks" appear in films that have been rapidly dried in spirit, when the spirit contains resin or gum, or has been used for a similar purpose before. If the films have been imperfectly washed or fixed before being put into the spirit, similar marks will appear.

"Iridescent surface markings" are often caused by drying the films in an atmosphere where gas is present. Silver sulphide is formed. The action is similar to that which produces dichroic fog (q.v.).

"Ink-stains" may be removed by bathing the film in dilute oxalic acid.

"Aniline dye stains" may be removed by washing the film in dilute hydrochloric acid.

"Permanganate stains" are very obstinate to remove.

"Grease stains" may be removed with benzene or ether and the film subsequently dried with spirit.

"Hypo-stains" are seen along the margin of the film, where it has been in contact with the side of the film holder; these are very commonly seen and are due to dirty film-holders; hypo-sulphite crystals adhere to the metal of the holder, and for their removal the holders should be thoroughly scrubbed every week with weak potassium permanganate.

Temperature Co-efficient of the Developer.—This is the time that the development must be prolonged or decreased for every degree of increase or decrease of the temperature of the developer from the normal 65° F.

Under 60° F. hydroquinone is inactive.

Temperature at 60° F.	...	7 minutes	} hydroquinone is very slow to act. = normal time.
" 62.5° F.	...	6 "	
" 65° F.	...	5 "	
" 70° F.	...	4 "	

Above 70° F. always causes chemical fog.

Films developed at a temperature under 65° F. are lacking in contrast and appear under-developed and under-exposed.

Films developed at 70° F. and over show marked stains or chemical fog and appear over-exposed.

It is important to remember, also, that the higher the temperature of the developer, the more rapidly will it oxidize, and consequently its life will be shortened.

(To be continued.)

Clinical and other Notes.

NOTES ON AN ATYPICAL CASE OF APPENDICITIS.

BY CAPTAIN G. MOULSON.

Royal Army Medical Corps.

LIEUTENANT K. W., aged 35, was admitted to hospital on March 18, with a history of influenza fourteen days before admission, and complaining of abdominal pain which had persisted for five days.

On admission the patient stated that he had been eating a full hotel diet with relish, that he had no nausea, vomiting or constipation, but for several days had been troubled by a constant diffuse pain across the abdomen and above the level of the umbilicus. This pain became worse on movement, and occasionally he felt vague pains in the small of the back. No history of primary symptoms was forthcoming.

On examination the patient looked ill and debilitated, and preferred to lie with both thighs slightly flexed. The tongue was moist and covered with a thin white fur, the temperature was 97.4° F., pulse 64, and respirations normal.

Examination of the chest was negative. The abdomen moved freely on respiration, there was no rigidity nor area of hyperæsthesia, and the abdominal reflexes were normal. On very deep pressure over the appendix the patient admitted some tenderness, but digital palpation *per rectum* failed to demonstrate any tender spot. The nervous system was normal. Routine and catheter specimens of urine were examined and no abnormal constituent was found.

A soap and water enema given shortly after admission relieved the patient's pain, and on the following morning he could lie comfortably with thighs fully extended.

For the first three days he was placed on a strict milk diet, but on the fourth day, as the tongue had cleaned and the patient was complaining of hunger, a little thin bread and butter was added. In the meantime the patient's chest and abdomen were examined twice daily and nothing which would throw fresh light on the case could be discovered.

On the morning of March 22 the temperature was still normal and the pulse varying between 50 and 60 beats per minute. It was thought, however, that slight resistance could be detected over the appendix, and on digital examination of the rectum the patient complained that the right side was definitely more tender than the left. This aroused the suspicion that an appendix abscess might be forming, so a total leucocyte count was carried out and reported to be 9,775 white cells.

On the morning of March 23 it was considered safe to administer a half-ounce dose of liquid paraffin. The patient had then been under observation for six days; temperature, pulse, leucocyte count were all normal; the pain still remained supra-umbilical in position and had never become

localized to the appendix area; the tongue was quite clean and the pain was causing much less discomfort than it did on admission. Late in the afternoon the paraffin took effect and was followed shortly afterwards by an exacerbation of pain which was now definitely referred to McBurney's point and accompanied by marked superficial tenderness, rigidity and all the classical symptoms and signs of acute appendicitis with the exception of vomiting, which never took place. By 6 p.m. the temperature had risen to 100·8° F. and the pulse to 80. An enema by rectal tube was administered and operation was fixed for 9.30 p.m. the same night.

Operation.—The abdomen was opened through a "Battle's" incision and the appendix was found without much difficulty. In direction, it was pointing towards the pelvis, and it was slightly fixed by a few very recent adhesions which could easily be separated by the finger. When brought to the surface the cæcum appeared somewhat inflamed and the appendix was bright red and considerably enlarged throughout. In length and thickness it was about $2\frac{1}{2}$ inches by $\frac{1}{2}$ inch. The meso-appendix reached to the tip of the appendix and its free border was so thickened and œdematous that on first sight it resembled an appendix kinked upon itself, the apparent kink being in reality the junction of the meso-appendix with the tip of the appendix. No sign of a perforation was present, so the appendix was removed with the usual precautions and the abdominal wound was completely closed.

On squeezing the appendix after its removal from the body, it perforated at the tip and was found to be distended with a large quantity of pus.

With the exception of chest symptoms which supervened two days after the operation and persisted for three days, the patient made an uninterrupted recovery. He had suffered from double pneumonia five years before. The wound healed by first intention.

Note.—The case seemed to be one of interest on account of the "flaring" condition of the appendix discovered at operation, which the preceding ten days of vague abdominal symptoms with little or no constitutional disturbance, hardly led one to expect. Possibly the debilitated condition of the patient, on admission, affords the explanation.

THE DIAGNOSIS OF INCIPIENT DISSEMINATED SCLEROSIS.

By MAJOR J. HEATLY SPENCER.

Royal Army Medical Corps.

THE case here reported presents some features of unusual interest in that there was an opportunity of investigation within a week of the onset of the very earliest symptoms of the disease—a chance which must rarely occur in the generality of cases.

Guardsmen D., aged 25, an apparently perfectly healthy young soldier of good physique, complained of dimness of vision in the left eye on waking

one morning. On admission a few days later he was examined by Major J. H. Gurley, R.A.M.C., Ophthalmic Specialist, and found to be suffering from a primary left-sided optic neuritis. The nervous system was carefully examined and found to be normal in all respects. Not one of the signs or symptoms of disseminated sclerosis was found, and yet the case was so suggestive that special diagnostic measures were at once undertaken. On careful questioning there was elicited a history of some transient sensory symptoms of the nature of tingling of the skin between the shoulder-blades four weeks before admission. A careful search for any toxic cause of the optic neuritis revealed nothing. A Wassermann blood test was negative. The results of the cerebrospinal fluid investigation in detail were as follows :—

Fluid clear ... Not under pressure.

Wassermann ... Negative.

Globulin ... Absent.

Cells ... 7/3·5

Colloidal gold test Definite curve of paretic type (5 5 4 4 3 3 2 2 0).

The complete absence of evidence of syphilis in combination with a definite Lange's curve in the cerebrospinal fluid is so suggestive that the diagnosis of disseminated sclerosis was held to be justified in order that a complete course of arsenic medication should be given. Dr. Farquhar Buzzard kindly saw the case and agreed with the provisional diagnosis.

This man while in hospital on two occasions since noticed numbness and tingling in the right foot. It is instructive to note the commencement of sensory symptoms in this case which are extremely important as a support to a diagnosis which would, perhaps, otherwise seem to have been unusually bold.

The writer is indebted to Majors J. H. Gurley and E. C. Lambkin and to Captain Hare for their special assistance in the clinical and pathological investigation of the case.

It is now generally agreed that there is usually a colloidal gold curve in the cerebrospinal fluid in this disease—this curve may be of luetic or paretic type—the latter being the more common, but the reactions are by no means diagnostic by themselves. In conjunction, however, with an absence of changes indicative of syphilis they become of distinct diagnostic significance.

A CASE OF FRACTURE OF BOTH FIBULÆ.

By MAJOR C. M. FINNY.

Royal Army Medical Corps.

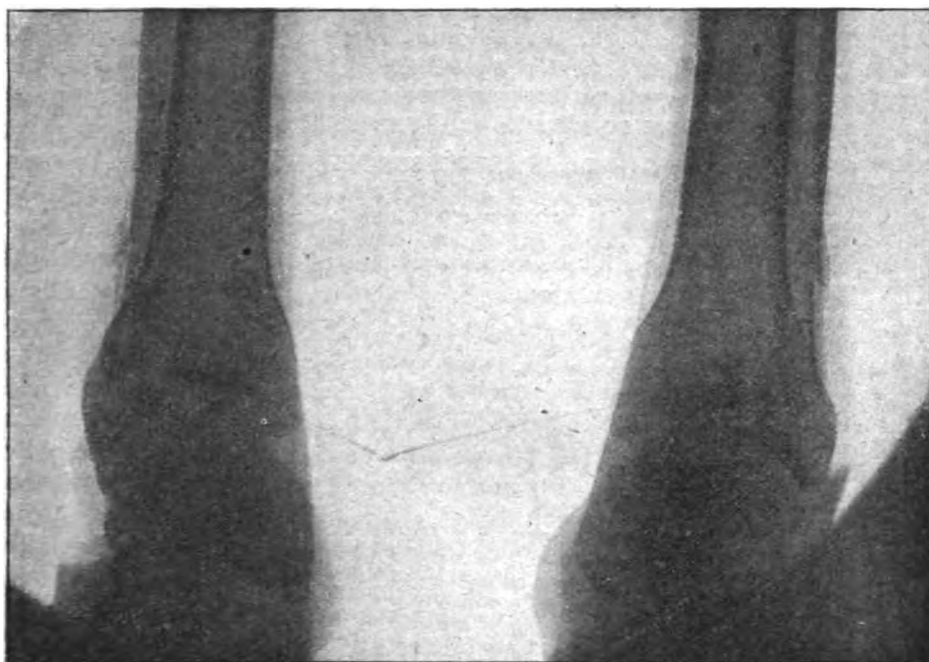
The following case appears worthy of record from several points of view.

Pte. A., 1st Gordon Highlanders, was running in an inter-regimental cross country race; when three miles from home he twisted his left foot inwards on a lump of earth, and, as he stumbled, twisted the other ankle

in the same way. However he picked himself up and continued to run, finishing twelfth out of a large field.

The next day he reported sick and was admitted to hospital. There was well-marked tenderness two inches above the tip of both external malleoli, and pain was felt in the same spot on compressing the fibulæ above. The X-ray showed a transverse fracture of both fibulæ two inches from their lower extremities with slight comminution.

He was treated with rest, and internal angular splints for a week, with daily massage, then active movements; and walking was allowed twelve days after the accident.



Radiogram of both ankles.

This case exemplifies how little the ankle-joint is affected by fracture of the lower end of the fibula, provided there is little displacement and no tendons are torn; though one cannot but admire the soldier's grit in carrying on in spite of his injury.

Forcible inversion of the foot is a very common cause of fracture of the external malleolus, but the line of fracture in such cases is generally oblique.

It is unusual to find a transverse fracture, and still more so to find both bones fractured in this way.

Textbooks lay so much emphasis on the Pott's fracture by eversion, and the necessity of prolonged rest in its treatment, that there is a tendency

to regard the fracture by inversion as a "Pott," and to treat it in the same way.

I am convinced that this is a mistake. Not only is prolonged rest a waste of time but it tends to delay early return of function.

This case shows that even violent active movement immediately after the injury did not appreciably delay a rapid recovery.

Report.

SECOND INTERNATIONAL CONGRESS OF MILITARY MEDICINE AND PHARMACY.

ROME, MAY 28 TO JUNE 2, 1923.

By ONE OF THE DELEGATES.

(Continued from p. 56.)

ON Tuesday we began the serious business of the Conference, varied as already said by Committee meetings and excursions; one of these by special train to Anzio, a small seaside resort about 30 miles from Rome was specially interesting. We were first of all received by the Municipality in the Town Hall and then proceeded to inspect the Field Military Climatic Sanatorium. This is situated in a pine wood about one mile from the shore, in huts and on sandy soil, and is really run by the Pensions people, but serving military cases are also received. All the men are suffering from tuberculosis, and we were assured that great success attended the treatment. The men are exposed to the sun daily without clothing, and are gradually enured to long exposure; some of them who had been there for some time were burnt almost black with the sun, their only protection being a Japanese sunshade. Heliotherapy under exceptionally favourable circumstances.

Lunch was served in a pavilion built on piles out into the sea, and consisted principally of macaroni and omelettes.

After lunch we went by car to Nettuno where the School of Malariology is situated. Here Professor B. Gosio gave a demonstration of mosquitoes and mosquito larvæ, their life history and methods of destruction. Apparently this school is used principally for the training of sanitary orderlies who are employed in the struggle against malaria in the Campagna, and it is peculiarly well situated for such a purpose.

"The Paradise on the sea," mentioned in the programme, was a new café under construction, and we were entertained in large caves cut out of the sandstone cliffs. Our hosts were Fascisti.

All the ordinary meetings of the Congress were held in a ward of the

large Military Hospital at Celio, a beautiful building, or rather buildings, for it is built on the pavilion system, and is capable of accommodating 1,500 patients. The equipment and buildings were thoroughly up-to-date and in excellent condition. In comparing such buildings with our home hospitals we must remember that Italy is a conscript nation and therefore all the youth of the nation pass through the army and incidentally, at one time or other, through the hands of the medical services.

On Saturday the conclusions arrived at by the Sub-Committees were submitted to the full meeting of Congress, and after some considerable discussion and modification, ratified. It was rather interesting to notice that one paragraph in our particular section, which had been included by our Italian colleagues after considerable resistance and modification on our part, was at once and unanimously turned down by the Congress, more especially by other Italian representatives.

There was also some difficulty over Theme V, as the manufacture of poison gas had crept in and apparently this was resented by several nations and all mention was tabooed.

CONCLUSIONS OF THE SECOND INTERNATIONAL CONGRESS OF MILITARY MEDICINE AND PHARMACY HELD AT ROME.

First Subject: Evacuation of Sick and Wounded: (1) General principles of evacuation in armies in the field; (2) Organization of evacuation as governed by the necessities of therapeutic considerations; (3) Adaptation of medical and surgical treatment to the diverse conditions resulting from the procedure necessary for evacuation.

Conclusions.

I. The general organization for evacuation of sick and wounded requires above all an effective collaboration of the high command with the medical services. The former should furnish the latter with all the information on the military situation which is necessary for the elaboration of a plan of action and the application of all general measures, as far as the situation permits. The medical service must study to adapt their arrangements to military circumstances.

The admission of medical officers on the General Staff and the appointment of Directors of Medical Services to the Staff of Generals commanding large bodies of troops are necessary for the execution of this principle.

II. In order to harmonize resources and the reciprocal needs and to unify methods, a permanent and close liaison should be established between the medical services of the forward areas (*zone des armées*) and those of the base (*zone du territoire*).

III. It is of great importance in the general organization and in the action of the medical services to strike a balance between technical and military necessities.

The technical necessities are:—

(1) Observation of the scientific principles which are concerned in the occurrence of wounds and of sickness.

(2) The results of these principles from the point of view of—

(a) The installation and specialization of medical units in the different echelons.

(b) The arrangement for the employment and the specialization of the technical personnel.

(c) The organization and carrying out of evacuation.

The appointment of highly qualified technical advisers to the staffs of the Directors of Medical Services with the armies and of the base (zones du territoire) will greatly facilitate the preparations for, and the carrying out of these technical requirements.

IV. The interests of the wounded and of the army in general require wide forethought, and a great abundance of personnel and material as perfect as possible, in order to assure in all circumstances rapidity of transport and evacuation and rapidity in the application of treatment. With this end in view, every attention must be given to the improvement and development of means of transport of all kinds, on land, on sea and in the air.

V. It is desirable that the different nations should study the unification of means of transport in their essential characteristics with the view of permitting interchangeability.

Second Subject:—Collaboration of competent civil and military authorities in matters of hygiene, physical education and prevention of disease (statistics concerning social maladies, i.e., tuberculosis, venereal disease, alcoholism, mental disease; research into beginning of disease; concerted prophylactic measures, vaccination, inoculation, etc.).

Conclusions.

I. Close co-operation between the civil and military medical authorities is necessary for the formation of a strong, healthy population which will provide citizens and soldiers of a robust type. The form of collaboration should vary with the requirements of the different countries.

II. In the interests of public health and consequently of the population from which the army is recruited, systematic medical examinations of school children should be made in order that physical and psychical defects may be discovered and remedied as far as possible. The documents thus obtained would form a medical history which could be presented by young men at the time of their inspection for military service.

III. The war formed a good opportunity for testing prophylactic measures especially as results can be better observed in bodies of troops than in the civil population.

(a) *Venereal Diseases.*—(1) Apart from continence, which should be

advised, the methods of prophylaxis in use cannot be regarded as absolute guarantees against infection.

(2) The greatest attention should be paid to the conditions of existence of the soldier, his housing, military occupations, and the filling of his leisure hours with games, etc.

(3) The soldier should be instructed in the dangers of venereal disease by means of pamphlets, lectures and educative films.

(4) Medical officers should instruct the troops under their care in the methods of use of antiseptics in venereal prophylaxis, but they should make it clear that these antiseptics are not infallible.

(5) All possible measures for early diagnosis must be employed and treatment should be begun at once and thoroughly carried out, inefficient treatment being a cause of spread of these diseases.

(b) *Tuberculosis*.—It is necessary to extend and encourage the organizations which have undertaken the campaign against tuberculosis. There should be a permanent and close liaison between the military authorities and these organizations. The results of prophylactic antitubercular vaccination are not definite but should be further studied.

(c) *Vaccines and Serums*.—(1) The value of prophylactic inoculation against the enteric fevers and cholera and vaccination against small-pox was clearly proved during the war, both as regards protection from and modification of these diseases, but inoculation against bacillary dysentery and influenza was not so successful.

(2) Tetanus and diphtheria antitoxins proved to be of the greatest value the former as a prophylactic, the latter as a curative agent, but except in the French and Belgian Armies the results of the use of sera in gas gangrene were not so favourable.

(d) *Mental Diseases*.—The study of these diseases by the military medical services is valuable and the war has shown the importance of this pathological group.

By making a careful mental examination, preferably during the period of observation after enlistment, it would appear possible to eliminate from the service those who are mentally abnormal and defective and the majority of epileptics as well as those suffering from psychoneuroses who frequently develop signs of disease under the strain of military-service.

Third Subject: Critical discussion of the processes of disinfection and disinfestation in times of peace and of war.

Conclusions.

(1) Disinfection can be carried out by natural means or by the employment of mechanical, physical and chemical procedures.

(2) Instructions for disinfection procedures should not be too schematized. They should be adapted to each different type of disease.

(3) Continuous disinfection and the most scrupulous cleanliness in the sick room are of the greatest importance.

(4) It is highly desirable, for practical purposes, to have a standard by which the substances used in disinfection can be compared and measured.

(5) For disinfestation (disinsectization) the methods which give the best results are those which utilize heat and especially dry heat. Of the methods in which gas is used, the employment of chloropicrine and of hydrocyanic acid are considered as most efficient. The toxicity of hydrocyanic acid must be taken into consideration.

(6) The employment of hydrocyanic acid should only be made with all necessary precautions, with a specialized personnel and under the control of technical experts following directions rigorously applied. When possible, the method of neutralization by formaldehyde described by Martinez Roca should be adopted.

(7) The personnel entrusted with disinfection and disinfestation duties should be specialized in knowledge of the subject.

(8) For armies, special detachments for the duties of disinfection and disinfestation are highly important.

Fourth Subject: Treatment of wounds of the chest and lung and their sequelæ.

Conclusions.

(1) In closed thoraco-pulmonary wounds, which have been caused by small projectiles (bullets or small pieces of shell) expectant treatment is advisable so long as there is little or no hæmothorax and when there is no hæmoptysis.

(2) Artificial pneumothorax constitutes a real advance in the cure of thoraco-pulmonary wounds.

(3) Prophylactic surgical treatment is always indicated in the case of exposed lesions of the thoracic wall, with or without fracture of ribs.

(4) Immediate intervention is nearly always indicated in open pneumothorax to stop bleeding and to prevent infection. On the other hand, in closed wounds with pneumothorax, spontaneous hæmostasis usually occurs but immediate intervention in the thoracic cavity may be indicated in cases of persistent hæmoptysis or where hæmothorax is increasing, and, above all, where there is retention of a projectile and where the size of the projectile exceeds that of a small fragment (*petit éclat*).

(5) In the case of cardio-pericardial wounds immediate operation is rarely indicated for the prevention of infection.

(6) In the war zone and in the rear zones it is necessary to have units specialized in the secondary and in the late treatment of thoracic wounds.

(7) In the secondary and in the late periods, projectiles remaining enclosed in the pleura, or in the lung, or in contact with the large vessels should, on principle, be removed. In the case of projectiles in the peri-

cardium or in the heart, the indications for intervention are dependent on symptoms of interference with circulatory functions.

(8) Pulmonary tuberculosis is a rare complication of thoracic wounds; however, a latent focus may be lit up or a developing focus may be aggravated.

Fifth Subject: Pharmaceutical Theme. Chemical laboratories in the Field: their scope and their methods.

Conclusions.

(1) The organization by the medical services of chemical laboratories adapted by their equipment and their methods for the needs of an army in the field, is necessary for the examination of water and of food stuffs and for carrying out clinical chemical examinations and for the various analyses required by the command and by the important army services.

(2) The methods to be used by laboratories with the armies must be reliable, rapid and easy to perform, their choice, varying with the progress made in knowledge, should constitute in time of peace a constant study for military pharmacists.

(3) The methods recognized as suitable for service in the field should be inserted in a special pharmaceutical formulary.

(4) In view of the importance of chemical examinations in the armies, the methods selected or elaborated by the pharmaceutical services should be discussed at future meetings of the International Congress of Military Medicine and Pharmacy.

After two days sight seeing, St. Peter's, Via Appia Catacombs, etc., we left Rome en route for Naples where we caught the Orient liner direct for Gibraltar.

A most interesting and instructive trip, although we cannot say that we learnt a great deal from the Congress, or that we added in any large measure to its success, except in that I think we may claim to have made some very good friends among the delegates of other nations, and this is no small thing; in this aspect of the Congress work we were greatly indebted to an unofficial delegate, namely, the wife of one of us. We would like to take this opportunity of expressing our gratitude and thanks to our Italian colleagues in the medical service for their great kindness and courtesy to us, namely to General Della Valle, the Director General, to Colonel Mauri and to Captains Ferri and Apolloni among others, and to express the hope that we may meet again at the next Congress which we understand takes place in Paris in 1925, we look forward also eventually to welcoming them to London.

130 *International Congress of Military Medicine and Pharmacy*

SECOND INTERNATIONAL CONGRESS OF MILITARY MEDICINE AND
PHARMACY UNDER THE EXALTED PATRONAGE OF HIS MAJESTY
THE KING OF ITALY.

Rome, May 28 to June 2, 1923.

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Travel.

A TRIP TO THE PANAMA CANAL.

BY COLONEL J. A. HARTIGAN, C.M.G., D.S.O.

Royal Army Medical Corps.

WITHIN reach of many of our foreign stations is a country or place of particular interest, which most officers develop a desire to visit during their tour in the vicinity. As far as Jamaica is concerned, such a place is unquestionably the Panama Canal. I therefore considered myself very fortunate in having recently had an opportunity of visiting it under very favourable conditions. The whole trip took twelve days.

Armed with many letters of introduction kindly furnished by Dr. McLean, Medical Superintendent of the United Fruit Company in Jamaica, we sailed from Kingston to Port Limon in Costa Rica, a journey of forty hours. It was a calm voyage, the north-east trade winds being—very unexpectedly—conspicuous by their absence. Most of the passengers, who had come direct from England, complained bitterly of the heat but after residence in Jamaica, a journey across the Caribbean in “mid-winter” felt almost bracing. We were fortunate to find on board a copy of “The Cradle of the Deep” by the late Sir Frederick Treves, surely one of the most delightful of the many books written on the West Indies.

Costa Rica (Rich Coast), said to be the most flourishing and most peaceful of the Central American Republics, was discovered by Columbus on his fourth trip across the Atlantic in 1502. It remained under the power of Spain till 1829 when it became independent. This little Spanish American entity is very mountainous, her mountains forming part of that mighty range extending from Alaska in the north to Magellan in the south.

The coast line is hot and fever stricken and most of the inhabitants are negroes. The principal towns are found inland at various altitudes. Tropical forests extend from the coast up to the mountain slopes yielding mahogany, cedar and other tropical timber. The soil is very fertile and the area under cultivation is rapidly increasing. Along the coast the coconut palm abounds, further inland are found bananas, cocoa and pineapple, and still higher are large tracts of the famous Costa Rican coffee which is said to command very high prices in the European and American markets. Turtles are captured in large numbers more especially on the Pacific side and a large trade is conducted in tortoise shell ornaments, a fact which the lady members of the party discovered in an incredibly short time!

Limon, the Atlantic port of Costa Rica, is still in a very primitive state. Except for a few large buildings wherein are housed the offices of the leading trading firms, the houses are poor and unattractive and the roads

are positively appalling. It is little wonder that the town can boast of only two motor cars and still less wonder that they are both of the "Ford" variety. A drive in one of them was strangely reminiscent of a similar means of progression on the Menin Road in 1915! About a mile from the harbour and built on a promontory jutting out to sea, is the United Fruit Company Settlement which forms a marked contrast to the rest of the town. Here are housed the employees of that huge trading corporation. It contains married quarters, single members' quarters, mess and recreation rooms (all mosquito proof), swimming pool, tennis courts and a small golf course.

The gardens are artistically laid out and the lawns and hedges are kept in apple-pie order. There is also a hospital, built on the most up-to-date lines, over which I was kindly shown by Dr. Facio the medical superintendent. Here are treated not only the employees of the company but, as far as the accommodation will allow, the poor inhabitants of the district. The wards were very crowded on the day of my visit. There were many negro patients showing signs of marked malarial cachexia with enormous spleens. I was also shown a case of advanced pellagra.

On the following day a party of about twenty of us from the ship made the trip to the capital—San José. One hundred and eight miles from Limon, the journey took six hours by the narrow gauge railway but the time passed quickly in admiring the beautiful mountain, forest and river scenery *en route*. For the first four hours the journey was made through thick tropical jungle but after that time, when we were about 3,000 feet above sea level, the country became more open and flat, cottages were dotted all over the landscape and here and there the larger houses of the coffee planters with the inevitable "barbacues" on which the coffee bean is passed through the many processes required before it is ready for exportation.

Eventually we reached the capital and here we found hidden among the mountains of Central America a modern city with a climate, similar to that of the high veldt in South Africa. San José is a city of some 50,000 inhabitants built on a large plateau, 3,890 feet above sea level. Besides the President's residence and the National Palace in which are installed the various ministries and the chamber of deputies, there are many buildings such as churches, colleges, schools, hotels, shops, etc., which would do justice to any European city. The streets are well laid out, noticeably clean, and lighted by electricity. One could not help being struck also by the number of public parks, all well looked after and all provided with a band stand as the Costa Ricans are very fond of music. There is an efficient tram service and taxi cabs are available in abundance. The National Theatre is a beautiful little building like a miniature of the Paris Opera House. It contains many handsome paintings. There are two railway stations to choose from and your choice would depend on whether you wished to go to the Pacific or the Atlantic!

The hospital is in every way up to date. One of the consulting surgeons is (like the writer) a graduate of Durham. He is very proud of his native city and he informed me with evident satisfaction that the Government is employing more school teachers than soldiers at the present time, a condition of affairs which does not obtain in some of the sister republics. The inhabitants are for the most part of pure Spanish descent, those of mixed blood being noticeably few. Spanish is of course, the National language and only a small proportion of the educated classes can speak English. San José and the surrounding district is rapidly becoming a favourite summer resort for Americans residing in the Canal Zone. Well pleased with our visit to the Capital, we returned to the ship next day and shortly afterwards sailed for Christobal, a twelve hours' journey.¹

Panama.—The Isthmus of Panama was Spanish territory till 1819, when it became independent. It then passed through many changes and vicissitudes, ultimately becoming one of the United States of Colombia. In 1903 it asserted its independence from the Colombian Government and became a separate republic. The population is about 350,000, consisting largely of a mixed race. The metropolis is Panama City near the Pacific entrance to the Canal.

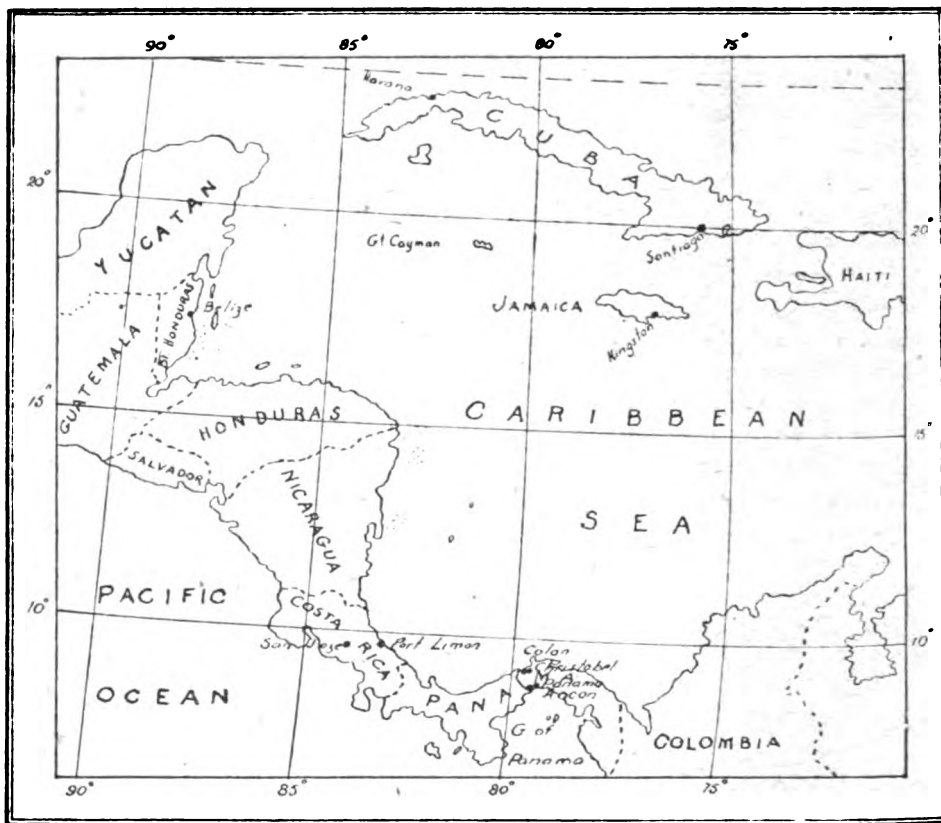
The "Canal Zone" is a strip of territory extending four miles at each side of the Canal, which is administered by the United States of America. The two cities—Colon on the Atlantic and Panama on the Pacific side—are, however, excluded from the latter administration except as regards sanitation—a detail which will be alluded to again later. Adjoining Colon and Panama respectively are the two American towns Christobal and Ancon. In each case the American and Panamanian towns are only separated by a roadway, a point of no little importance, in view of the fact that the Republic of Panama has not yet deemed it necessary to adopt prohibition!

The administration of the Zone, which is under the War Department at Washington, is presided over by a Governor who is invariably an officer of the Engineer Corps of the United States Army, and similarly the Chief Health Officer is a regular officer of the United States Medical Corps. Otherwise the officials are mainly civilians, and the administration of the Zone is quite distinct from that of the Army stationed therein.

The Panama Canal.—As this canal is not so well known to the members of the Corps as her elder sister of Suez, a few details may be of interest. It was first begun by a French Company in 1882 and continued till 1889, when the attempt failed mainly owing to the appalling mortality from yellow fever and malaria. During that period 5,000 deaths occurred at the Ancon Hospital alone, of which 1,200 were from yellow fever. Many of the cases were admitted to the hospital with injuries or minor ailments, but developed yellow fever after admission. There was during that period a devoted Sister Superior in the hospital who spent her spare

¹ Since our visit San José has suffered from a severe earthquake.

time in gardening. In order to prevent the destruction of her plants by the voracious "Umbrella" Ant, she had a low concrete wall built round her garden with a narrow shallow gutter filled with water over which the ants could not navigate. In these pools the yellow fever mosquito bred, and so the unfortunate patients became infected. It is not often that a praiseworthy act is followed by such calamitous results.



Scale 1: 20,000,000 (320 miles = 1 inch) Statute Miles

FIG. 1.

A new French Company was formed in 1894, but eventually the work was taken over by the United States in 1904 and completed in 1914. It was on August 15 of the latter year that the canal was first opened to world traffic—a time when the minds of Europe were centred in another place.

The canal, which is fifty miles in length, does not, as is generally supposed, run from east to west, but from the north-west to south-east, the Pacific entrance being actually twenty-two miles east of the Atlantic

entrance. The dominating feature of the canal is the Gatun Lake which forms nearly three-quarters of its whole length.

This fresh water lake, entirely artificial, is the result of impounding the waters of the river Chagres by means of the enormous Gatun Dam. The latter, a huge structure of earth and rock, is nearly half a mile wide at its base and $1\frac{1}{2}$ miles in length. Viewed in its present state it is difficult to imagine the dam being artificial as it looks part of the landscape. Its surface now functions as part of a golf course. By means of this dam the water in Gatun Lake is maintained at eighty-five feet above sea level, and thus



FIG. 2.—A railway bridge over one of the many rivers in Costa Rica.

an enormous amount of excavation was obviated. The escape of water from the lake is controlled by a "spillway," a semi-circular construction of concrete with steel gates. By means of a hydro-electric plant the escaping water generates sufficient power to operate all the machinery in the locks and to light the Canal Zone. The Culebra Cut—that part of the canal which is most heard of owing to occasional slides—is really an arm of the lake. It is nine miles long and cuts through the continental "divide." Enormous dredgers were at work in the Cut when we went through.

The Locks.—While there is a tide of only twenty-six inches in the

Atlantic, that on the Pacific is ten feet—hence the necessity for locks. Of these there are three sets, all constructed in pairs so that two vessels can pass in opposite directions at the same time. Each lock chamber is 1,000 feet long and 110 feet wide. The locks are magnificent structures, built of concrete and steel, and are worked entirely by electricity. At each lock there is a high building from which the working of the lock is controlled. No ship is allowed to pass through the locks under her own power, but is towed through by electric locomotives which run on tracks along the lock walls.

A journey through the canal is most interesting; it takes eight hours. Starting from the Atlantic end there is a stretch of about seven miles before one reaches the Gatun locks. During this stage one crosses at an



FIG. 3.—One of the electric locomotives towing our ship through the Gatun locks.

acute angle the old French canal now much frequented by pleasure boats from Colon. As one approaches the locks the sight of several steamers on the Gatun Lake, eighty-five feet above, is a very striking one. The ship then enters the flight of three locks and rapidly emerges on the lake. One could not help being struck by the clock-work precision with which the passage through the locks was carried out. Scarcely a word was spoken, and everything was directed from the control house by electrical appliances. The ship then proceeds at a good speed through the lake, thence through the Culebra Cut, at the end of which she enters the Pedro Miguel Lock, and is lowered thirty feet to a small lake (Miraflores). After traversing this lake she arrives at the locks of the same name where, by means of a flight of two locks, she is lowered fifty-five feet to sea level. A channel about $8\frac{1}{2}$ miles in length completes the journey to the Pacific Ocean. We

passed through the Miraflores Locks after dark. The locks were brilliantly illuminated and the scene was extremely picturesque.

The construction of the Panama Canal has been described as the world's greatest engineering feat. What is no less wonderful is the magnificent medical and sanitary work which made its construction possible. President Roosevelt appreciated that fact, and it is recorded that he informed a Committee of the American Medical Association that he wanted the best man in the world for the task, and having found him, that he would give him full power. His choice fell on the late General (then Colonel) W. C. Gorgas who was at that time employed on similar work in Cuba. That his choice was a happy one everyone now knows, as his work in the Panama has become a byword among sanitarians all over the civilized globe and no name is held in such high esteem by all classes in Panama to-day as that

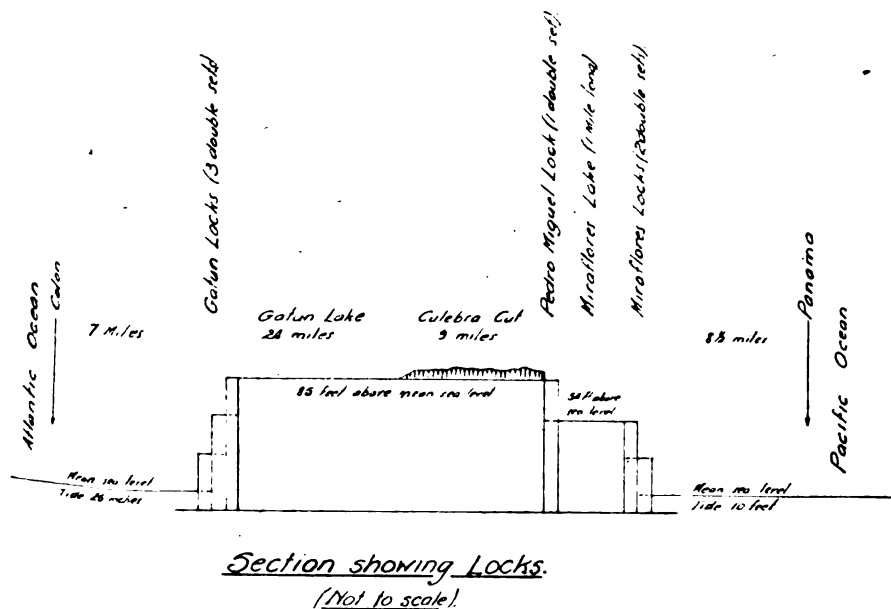


FIG. 4.

of Gorgas. Colonel Gorgas was Chief Health Officer of the Canal Zone, a position now held by Colonel Henry Clay Fisher, U.S.M.C. To the latter officer I owe a deep debt of gratitude for his great kindness to me during my visit and the facilities he gave me of seeing the work which is now being done under his direction. He also furnished me with much of the data which is used in these notes. In addition to his sanitary duties Colonel Fisher has administrative control over all medical personnel, hospitals, etc., in the Canal Zone (excluding the Army and Navy). At the Pacific end of the Canal is the City of Panama, the oldest city on the American continent and the Capital and seat of Government of the

Republic. It is a typical old Spanish city of some 50,000 inhabitants with a fine old Cathedral and many churches. The streets are narrow and tortuous and many of the shops are laden with Panama hats which are obtainable for sums varying from 10s. to £50. Curiously enough, all these hats are imported from Ecuador. Separated by a road from Panama City is the American town of Ancon, the most conspicuous buildings in which are the famous Ancon Hospital and the Tivoli Hotel. The latter, which is very comfortable, is under the direction of the Zone Administration. Adjoining Ancon is Balbao (named after the discoverer of the Pacific), a feature of which is the Headquarter Offices of the Canal Administration—a very handsome building. At Ancon and Balbao reside the Americans and Europeans employed in connexion with the Panama Canal and the Offices of the Headquarter Staff of the Army stationed in the Zone. Although one had previously heard of the beauties of these two settlements, one could not help being agreeably surprised at their most attractive appearance. The very pretty flower-clad houses, the well-kept lawns and hedges, and the beautifully laid out roads make a very pleasing picture. Along each side of the main avenues is a row of stately royal palms, and as all the roads are either of concrete or asphalt, there is a complete absence of dust. Many other smaller settlements are established at various points along the Canal as well as separate settlements for native employees.

The Ancon Hospital is claimed to be the most beautiful tropical hospital in the world, and after being taken over it by the superintendent (Lieutenant-Colonel Piles, U.S.M.C.) one had little doubt that the claim was well justified. When the Americans took over the Canal in 1904 they also took over the old French Hospital at Ancon. In this many improvements were at once carried out, buildings were enlarged and screened, modern sanitary appliances installed and new equipment procured.

The present magnificent structure was begun in 1915 and completed in 1919. It is said to have cost two million dollars to build, and its equipment is valued at another million. It is beautifully situated at the base of Ancon Hill and the avenue of approach is called Gorgas Road. Built of reinforced concrete, the roof is covered with vitrified Spanish red tile. The central building contains the administrative offices, record room, four operating theatres, out-patient clinics and X-ray department. Radiating from the central block are five "ward groups" each consisting of four wards (two on each floor) with a dining-room, kitchen, dressing-room, laboratory, medical officer's room, nurses' room, etc. There is also an isolation section with accommodation for over 100 cases, and in addition a section containing forty rooms for the use of private patients. The total capacity of the hospital is 880 beds which could be increased to 1,200 in emergency.

Although the Superintendent is an officer of the Medical Corps of the United States Army, it is not a military hospital. It is primarily for the

use of employees of the Canal Administration, but naval and military patients are also sent there. In addition private patients from all parts of the world (especially South America) are admitted, the rates being 5 dollars per day for ward treatment and 7.50 dollars for a private room. Extra charges are made for surgical operations, X-rays and special nurses.

A point which quickly attracts the notice of the visitor is that many of the doors are marked "Gold patients only," "Silver patients only." This is but another way of saying "White patients only," "Coloured patients only," and it is based on the fact that while all white employees are paid on the gold basis or United States currency, coloured employees are paid in local currency.

The staff of the hospital consists of 33 medical officers, 90 nursing sisters and about 150 female attendants. The medical officers are appointed from civil life and are given Civil Service status. They do not engage in private practice.

Water supply.—Filtered and disinfected water is supplied not only to the occupants of the Canal Zone and to the cities of Panama and Colon but also to ships passing through the canal that may require it. The price charged to a ship depends on whether she is at anchor or alongside a dock. During the year ended June 30, 1922, 121 million gallons of water were disposed of in this way.

Three purification plants are in use. Colonel Fisher very kindly took me to see that at Miraflores. The water is pumped from the Chagres River through eleven miles of three foot cast iron pipes. Mr. George C. Bunker in his article on the water supplies of the Panama Canal describes this plant as follows:—

"The plant consists of the following units: An aeration basin, 86 by 130 feet in plan, equipped with 105 spraying nozzles; a head house containing three baffled mixing chambers of the under and over-flow type, alum storage space, solution tanks, and bacteriological laboratories; three cross-connected, parallel, concrete sedimentation basins with a total capacity of 4,500,000 gallons, measuring 300 feet by 125 feet in plan by 17 feet deep, each of which contains two solid baffle walls in which there are five rectangular openings near the top; a filter box into which the settled water flows; a filter building containing 14 rapid sand filters of the gravity type, with a combined filtering area of 5,950 square feet, an office and laboratories; an 820,000 gallon clear water well under this building; two concrete tanks, combined capacity 1,000,000 gallons; from which wash water is furnished to the plant and a general supply for the Pedro Miguel district and Fort Clayton; a small concrete building for housing duplicate chlorinators; and a pump station in which there are pumps for filling the wash water tank and an air compressor for air-washing the filters."

The capacity of the plant is seventeen million gallons per diem and the average daily output in 1922 was 7,860,000 gallons.

Here are also maintained physical and chemical laboratories for testing fuel oil, petrol, kerosene, asphalt, paints, etc., and for carrying out researches of various kinds.

Anti-Mosquito Work.—It is of course in this particular branch that the medical profession has won its greatest triumph in Panama. Many excellent books have been written on the subject and it is only necessary to make a passing reference to it here. To fully appreciate the immensity of the task one has to go over the ground oneself and see the natural difficulties that the authorities had, and still have, to contend with.

Enormous tracts of the country form ideal breeding ground for the mosquito but these pests are being slowly but steadily driven further away from the centres of habitation. Roughly speaking, areas are sanitated for a distance of one mile from all settlements, and in addition large breeding places discovered beyond that limit are at once dealt with. Every opportunity is taken to extend the sanitated areas by the installation of permanent drains, filling, etc. The lack of material limits the amount of filling that can now be carried out and for that reason I am inclined to think that the news of a slide in the Culebra Cut, with the resultant supply of filling material, is not entirely unwelcome to the Sanitary Authorities.

It need hardly be said that such precautions, as prophylactic quinine, screening of houses, oiling, etc., are carried out with great thoroughness, in fact one could not help being struck with the keenness and the close attention to detail with which the whole campaign is being maintained.

As a result of dredging operations, varying climatic conditions, etc., new breeding places are constantly appearing but this is looked upon as part of the day's work and dealt with accordingly. As an example of unexpected difficulties may be mentioned the recent growth of dense aquatic plants which have invaded large surfaces of the lake areas. These were found to teem with *Anopheles* larvæ. They are now being dealt with by oil (previously heated) sprayed from a tank carried in a motor boat. The maximum flight of the female mosquito is of course a question of enormous importance to the Sanitary Authorities in the zone and there seemed to be a tendency among them to the opinion that, when food is not available nearer, she can travel much farther than is generally believed.

Coloured labourers, who used to be employed in digging the canal have recently been allowed to return to the Zone and work on the land. They are not allowed, however, to reside within one mile of important settlements. As these individuals are scattered over wide areas which it is not possible to sanitatate, malaria is prevalent among them.

The admission rate per 1,000 employees for Malarial Fever during 1922 was 17 as compared with 514 in the year 1905 and the death rate from all causes during the former year was 6.89 per 1,000. The number of cases of Malaria from all sources that have been reported to the Chief Health Officer has been pretty constant during the last few years and it

would appear doubtful that any further marked reduction is likely to take place. In fact the present satisfactory condition is only being maintained by unending supervision and watchfulness on the part of a very efficient and experienced staff.

Previous reference has been made to the fact that the United States has sanitary control over Colon and Panama though these cities are not included in the Canal Zone proper. There is a health officer for each city appointed by the Governor of the Zone. Their authority in sanitary matters is final in their respective cities, in addition to which they are empowered to sit as petty magistrates and impose fines on persons not complying with the sanitary regulations. Thanks to the courtesy of Doctor Henry Goldthwaite, the health officer at Panama, I had an opportunity of observing the state of sanitation in that city. It was, by far, the cleanest I have seen in the tropics and would compare very favourably with many cities nearer home.

A tour of service in the Canal Zone is very popular among American officers; a tour lasts three years during which there is a generous allowance of leave and passages to the United States are granted at very reduced prices.

The favourite pastimes of the residents in the Zone are baseball and golf (one American officer referred to the latter as foot-and-mouth disease!). There are many pretty golf courses available including two at the Pacific end. One of the latter is generally referred to as the nineteen hole course and is—needless to say—outside the Canal Zone area.

A very pleasant and instructive month could be spent in Panama but after five days—during which we received great kindness from the American officials—we had to return. We travelled to Christobal by the train which runs for the most part along the side of the Canal and the shores of the Gatun Lake. The hundreds of dead stumps of trees in the latter give a very weird effect of desolation. This railway is said to have cost a human life for every sleeper.

A very rough passage of two days duration from Christobal to Jamaica furnished an unnecessarily unpleasant conclusion to an otherwise most enjoyable holiday.

I am indebted to Qrmr.-Serjt. F. W. Bazley, Royal Engineers, for the drawings accompanying these notes.

Current Literature—Ophthalmology and Pathology.

Are There Among Blinded Ex-soldiers Curable Cases? A Report of such a Case. By Dr. Bonnefon (*Bull. Acad. Méd.*, Paris, xc, 36; October 30, 1923, p. 258).—A soldier had had his left eye destroyed, and a perforating wound with injury and detachment of the retina in the right eye as the result of the explosion of a shell. A secondary cataract developed and all perception of light was lost. Six years later he came under the care of the author who noticed that, although perception of light was very slight, the motor reaction to light was well marked. In spite of the almost hopeless prognosis, he decided to operate and extracted the cataract. At the first dressing, the patient was unable to perceive the shadow of a hand held half a metre away, but after the final dressing was removed, the retinal sensibility rapidly increased, and he returned to his home with a vision of $\frac{1}{50}$. Six months later, the vision was $\frac{3}{10}$ and the patient had been able to resume his work as an agricultural labourer.

Experiments in Preventive Vaccinotherapy in Exanthematic Typhus, Scarlatina, and Measles. Savini (*Compt. Rend. Soc. Biol.*, lxxxix, No. 26, 1923, p. 694).—Since 1917 the author has been preparing a vaccine by taking blood from one or more patients (mono- or polyvalent vaccine), adding to it in the syringe or cupping glass half as much again of an anti-coagulate solution (citrate of soda at five per cent). The vaccine is sterilized by heating it in a bain-marie at 50° C., or by the addition of one per cent of pure phenol to the citrated solution. The virulent material ought to be collected from the fifth to the seventh day of the disease in typhus, during the first two or three days in scarlatina, during the twenty-four hours preceding and the twenty-four hours following the beginning of the eruption in order to obtain a virus of sufficient concentration. The injection should be made on three consecutive days, morning and evening, under the skin of the side—four to five cubic centimetres each time for an adult and one to two cubic centimetres for a child. All the persons immunized by the author, viz., 30 against typhus, 26 against scarlatina, and 7 against measles, have resisted all the most severe tests of infection. The advantages of this method would be, according to the author, the activity of the immunization, its specificity and its innocuity. The author considers that the method might be improved by only using the leukocytic layer of the plasma where the vaccine seems to be found in the largest quantity; the phenol might be replaced by tricresol or metacresol. Glycerine also might be employed as a conservative medium. In the case of scarlatina and measles the preparation of a vaccine taken from the nasopharyngeal exudation and mucus might be

tried, as in whooping cough. Finally, the attempt might be made still further to reduce the number of immunizing injections.

This method employed as curative vaccinothrapy has given the author encouraging results in exanthematic typhus; they were only moderately good in scarlatina and measles even when accompanied by vaccinothrapy with associated microbes. Moreover, the treatment by serum of convalescents at present used has not given the best results especially as regards symptoms due to secondary infection.

Contribution to the Experimental Study of the Duration of Immunity to Typhus in Men. By Alfred Schnabel, R. Koch Institute, Berlin (*Deutsch. mediz. Woch.*, July 27, 1923, p. 972).—A woman doctor, who had had exanthematic typhus three and a half years previously, was exposed for ten consecutive days to the bites of lice infected with the virus. Two days after the end of the experiment her serum agglutinated X_{19} at a titre of 1 in 2,000, whereas before the experiment it was not at all agglutinant. No appreciable clinical symptoms could be observed.

The author concludes from this that the person in question did not enjoy absolute immunity; even although the attack of typhus, which dated back three and a half years, allowed the subject of the experiment to escape all symptoms when exposed to great and repeated infection, yet it did not prevent the appearance of specific agglutinin.

Having inoculated a rabbit intravenously with virus (infected lice), the author estimated that the agglutinating power of its serum rose ten days later to 1 in 90 or 1 in 80 against X_{19} . Three months later the serum titre was barely 1 in 10. The author reinoculated the rabbit with the virus (brain of infected guinea-pig). As a result of this fresh inoculation the agglutinating power did not undergo any modification, whereas two fresh rabbits inoculated under the same conditions showed an appreciable agglutination (1 in 90 or 1 in 80).

It follows that in the rabbits the immunity acquired as the result of a first attack is sufficiently effective to prevent a new infection, given three months later, from producing any Weil-Felix reaction.

Antityphoid Inoculation by Digestive or Parenteral Routes. F. Neri (*Annali d'Igiene*, xxxiii, No. 9, p. 609).—The author has made a comparative study of the digestive and parenteral routes for the antityphoid immunization of the rabbit in four series of experiments made from June, 1922, to February, 1923.

For immunization by the digestive route he administered by a stomach tube first of all 10 cubic centimetres of ox-bile to adult rabbits (over 1,500 grammes in weight), then, by the same route after sixteen hours fasting, a suspension of typhoid bacilli killed by phenol (25,000 million to 10 cubic centimetres), and, at the same time, another 10 cubic centimetres of bile. Typhoid vaccine was administered to other rabbits by the rectal route.

Immunization by the parenteral route was obtained by injecting under the skin or into the veins of adult rabbits different doses (from 1,000 to 5,000 million) of typhoid bacilli either living or dead. Blood was taken from the heart on the tenth day after inoculation.

On the twelfth day, all the rabbits treated, and at the same the control rabbits, were intravenously inoculated with more than three fatal doses of typhoid bacilli.

The control rabbits died in eighteen hours from Eberthian septicæmia. The rabbits treated once only by the digestive route (gastric or rectal) died in twenty-four to twenty-eight hours also from typhoid septicæmia. Of the rabbits treated by the intestinal route, only one survived, in the case of which the treatment *per os* had been repeated. The rabbits inoculated by the parenteral route all survived except one, which had been subcutaneously injected and which died on the tenth day from a delayed form of typhoid infection.

The surviving rabbits, killed fourteen days after inoculation, all showed typhoid cholecystitis or typhoid localizations. The serum of the rabbits treated once by the intestinal route did not contain agglutinins or bactericidal antibodies *in vitro* or bacteriotropic substances in appreciable amount. The serum of the rabbit which was treated twice *per os* and survived contained a larger quantity of agglutinins than that of rabbits treated only once. The serum of rabbits inoculated by the parenteral route showed strong agglutinating bactericidal and bacteriotropic power.

The results of these experiments show that :

(1) Large doses (up to 25,000 million) of dead typhoid bacilli, administered to the rabbit once by gastric tube, after the ingestion of bile, do not confer any immunity against the inoculation of virus by the intravenous route ;

(2) The repetition of the administration of typhoid antigen by the gastric route after the ingestion of bile may confer on the rabbit immunity against the intravenous inoculation of virus ;

(3) Rabbits treated once by the intestinal route, which do not resist the inoculation of virus, die from typhoid septicæmia, without intestinal localizations, and are affected in the same way as control rabbits ;

(4) One single inoculation by the parenteral route (subcutaneous or intravenous) confers certain and permanent immunity against the intravenous inoculation of virus ;

(5) Whatever route is used for immunization, antityphoid immunity always has a general character, as shown by the presence of specific antibodies in the blood ;

(6) Assuming the general character of the antityphoid immunity and in the absence of any typhoid enterotropism, considered as an intestinal localization, there are no facts to support the hypothesis of an antityphoid immunity of a local intestinal character ;

(7) Acquired antityphoid immunity, even when permanent and following

on intravenous inoculation, does not protect the rabbit against typhoid cholecystitis.

The Schick Test at Thursday Island. A. J. Metcalf (*Med. Journ. Australia*, February 2, 1924, p. 111).—During an examination of the records of the Torres Straits Hospital, the death register and other documents, it was noticed that no report of any case of scarlet fever and few of diphtheria could be found, though the records go back to 1883. Thursday Island has a population of about 1,400, with approximately 400 white residents. It is by no means isolated, as constant communication is maintained with various Australian ports as well as with China, Japan and other Asiatic countries, so that the risk of introduction of diphtheria is by no means negligible. Owing to the absence of endemic diphtheria it was thought probable that all the children would be non-immune to diphtheria and that the introduction of a case might lead to grave results. With the object of investigating this question a series of Schick tests was carried out. The following table of results shows that this expectation was borne out.

Ages	Number tested		Results				Percentage of reactions
			Reaction	No reaction			
4 and 5	..	16	..	16	..	0	100
6	..	23	..	22	..	1	95
7	..	14	..	13	..	1	92
8	..	20	..	19	..	1	95
9	..	14	..	14	..	0	100
10	..	16	..	16	..	0	100
11	..	20	..	18	..	2	90
12	..	18	..	18	..	0	100
13	..	8	..	8	..	0	100
14	..	4	..	4	..	0	100
15	..	3	..	3	..	0	100
All ages	..	156	..	151	..	5	96.8

The following are the nationalities of the tested children :—

Nationalities			Number		Number reacting	
Whites	58	..	57
Chinese	17	..	17
Japanese	2	..	2
Half-castes of different nationalities	79	..	75

Dr. Park states that the percentage of positive results is higher in rural areas than in cities. The author's results certainly bear this out.

The Effect of Anæsthesia and of Sedatives on the Serum Therapy of Experimental Botulism. J. J. Bronfenbrenner and H. Weiss (*Journ. Exp. Med.*, xxxix, No. 4, April, 1924, p. 157).—When guinea-pigs are fed with large amounts of botulinus toxin, they develop symptoms of intoxication within six hours and die usually within twelve hours after the feeding of toxin. If very large amounts of toxin are introduced intraperitoneally, the animals may show symptoms of intoxication at the end of the first hour and die usually within two hours following the administration of toxin.

If these animals are placed under anæsthesia following the administration of toxin, the intoxication proceeds much more slowly.

Anæsthesia, by ether, is effective in this manner whether the toxin is given *per os* or intraperitoneally. The life of guinea-pigs kept under ether after the administration of lethal amounts of toxin is prolonged by a period approximately equal to that during which the administration of the anæsthetic is continued. When anæsthesia is discontinued, the intoxication proceeds at its usual rate. It appears, therefore, that administration of ether delays the rate of intoxication but does not alter the toxin or the nature of the mechanism of intoxication. Anæsthesia delays the progress of intoxication not only when administered immediately after the intake of toxin but when administered much later after the intoxication has already progressed far enough to cause definite objective symptoms of poisoning. At this late stage of intoxication, the unsupported serum therapy of botulism in guinea-pigs usually remains without effect. If, however, the animals are anæsthetized at this time and kept under the influence of ether for some time, antitoxin therapy becomes effective. Indeed the antitoxin treatment can be delayed further for several hours, provided the animal is kept under anæsthesia during the interval.

Results of a similar nature were obtained with luminal sodium, nitrous oxide-oxygen mixture, and morphine used in place of ether.

In view of the fact that the published data indicate that botulinus antitoxin has thus far failed to give beneficial results in the treatment of botulism in human beings because, as it would seem, of the rapid progress of intoxication, any method of delaying the progress of intoxication to supplement the antitoxin therapy deserves consideration.

Warfare Gas and Tuberculosis. Testimony of Dr. Albert P. Francine before the Select Committee of the Senate on Investigation of United States Veterans' Bureau, taken October 30, 1923 (*The Military Surgeon*, April, 1924).—Evidence given in view of complaints upon the part of disabled soldiers (i.e., those suffering from tuberculosis) that they have been unable to secure compensation from the Government because of rulings by the Veterans' Bureau that their disability was not due to service.

Dr. Francine was called upon for evidence in view of the fact that he had had a great deal of experience with tuberculosis and diseases of the chest prior to the war during which he served first as a divisional tuberculosis specialist and later as consultant in gas to the 4th Army Corps, in the course of which he functioned as Chief of the Staff at the Gas Hospital near Toul.

In the course of his evidence he states: "I have seen a large number of men who gave a history of gassing and who attributed their symptoms to gas, and who claimed to have tuberculosis, who believed they had it, and who had been told they had it, and that diagnosis has been made very

widely. I think that of such cases the error in diagnosis is over fifty per cent at least. It has become increasingly apparent that such an error is not so likely to be made now, because the gas cases are clearing up; and we now have a definite picture of the symptomatology and physical signs of the effects of gas as distinct from the effects of tuberculosis. Though they are similar in certain respects, and so similar, in fact, that it is not at all surprising that a number of men, particularly men who did not study their cases carefully, and perhaps men of not very broad experience, should have made this error in diagnosis."

He goes on to say that he made careful examination of the lung condition of all men who died as the result of gassing (less than two per cent of gassed cases) to determine whether latent tuberculosis lesions had been activated following "gassing." He examined between 100 and 125 bodies. Those having latent lesions were common but none showed evidence of re-activation from four to six to ten weeks after the acute inflammation which is supposed to have given rise to tuberculosis.

At the same time he saw a considerable number of men who had been severely gassed and were recovering, who died from intercurrent infection—influenza, etc. Such men would have had plenty of time to develop activity in any latent tuberculosis lesions, but in no instance was this discovered.

He goes on to say: "I believe that so far from producing tuberculosis—anybody might, indeed, think so on account of the local irritation in the lungs and bronchi—gas may tend to prevent tuberculosis, and I will tell you why. Because its primary action is to produce congestion of the lungs. In fatal cases it causes severe inflammation followed by congestion and œdema and prevents the aeration of the blood and quickly smothers, so to speak, the patient. He cannot get air into his lungs or blood. When the man drowns or smothers he is suffering primarily from inflammation caused not by a germ but a chemical. We know that non-bacterial congestion or hyperæmia is a favourable factor in tuberculosis. In other words, if we could produce locally in the lungs a congestion, we could go far toward curing tuberculosis."

"Further, it has been claimed clinically that men who have tuberculosis and have been gassed run a more favourable, slower, more indolent course, are better off over the same period of time, improve more, than the same type of tuberculosis cases who have not been gassed. That we learn from clinical observation only."

He was asked what kind of gas he was considering particularly, and answered, "I am speaking of all the toxic gases."

He was asked if his testimony applied not only to mustard gas but to those other gases that were used, and replied, "My post-mortem experience applies more specifically to mustard gas."

He also stated: "There are not a great many cases of permanent injury to the lung tissue from the inhalation of gas . . . the permanent

effects of gas are the result of irritation . . . and what follows all inflammation and congestions, if they last long enough, is broadly speaking the destruction of the finer cellular tissue in places and its replacement by fibroid tissue . . . and these post gas lungs show, in the very bad cases, the remains of this change, which is still being mistaken for tuberculosis. But they clear up."

He was asked by the Chairman : "Have you known cases where the destruction of lung tissue and its replacement by the fibroid tissue was so extensive that the man was seriously affected several years after the injury?"

He answered : "No, sir, I never have, nor have I heard of such cases."

Major-General O'Ryan said : "The Gas Service of the Army sent out 200 personal letters to medical officers of the Reserve Corps, the majority of whom had had extensive experience in treating gas cases, both during and following the war, with the request that they express their views concerning the relationship between tuberculosis and warfare gassing. Of this number 41 per cent did not reply, 47 per cent were of opinion that, as a rule, there was little or no connexion between the after effects of warfare gases and tuberculosis; 13 per cent were of opinion that in some cases relationship existed between these conditions.

"Of the replies from thirty medical officers associated with Government hospitals where ex-soldiers are being treated for tuberculosis, twenty-five stated that with few exceptions there was no connexion between gassing and tuberculosis; these officers based their statements on 16,575 cases which they had seen. Five medical officers who saw 2,030 gassed cases were of the opinion that there was a relationship between tuberculosis and gassing.

"Of replies to questionnaires pertaining to this subject, which were sent all over the United States through the different medical associations, eighty-four per cent were of the opinion that there was no relationship existing, and sixteen per cent were of the opposite view."

In comments on the above evidence by Lieutenant-Colonel H. L. Gilchrist, Chief of the Medical Division Chemical Warfare Service, he points out that Dr. Francine's evidence is generally in accord with conclusions already arrived at by inquiries made on the subject by a Board of Medical Officers convened shortly after the war, and with the results of an extensive investigation early in 1921 undertaken by the Medical Division of the Chemical Warfare Service, which occupied nearly two years.

Reviews.

THE MEDICAL DEPARTMENT OF THE UNITED STATES ARMY IN THE
WORLD WAR. Vol. v. Military Hospitals in the United States.

This volume has been prepared by Lieut.-Colonel F. W. Weed, Medical Corps, United States Army, under the direction of Major-General M. W. Ireland, Surgeon-General of the Army. In the preface we are told that the purpose of the volume is to record experiences incident to the provision and administration of military hospitals in the United States, and to record the histories of individual hospitals.

In the introduction there is a short account of the evolution of the military hospital. The first hospital in the United States was established on Manhattan Island in 1658, and in 1679 it consisted of five houses. In the American Revolution the sick and wounded were located in all kinds of houses; the resources of the country did not permit the building of hospitals. During the winter of 1779-80 Dr. James Tilton did away with the hospital tents and private houses then in use and caused a large number of log huts to be constructed. They were roughly built, and air could penetrate through the crevices; the floors were made of baked earth, and each hut accommodated eight to twelve men. During the Civil War the sick and wounded were placed in hotels, churches, factories, and increased accommodation was obtained by erecting tents, and in some instances long wooden pavilions. The first hospitals constructed on the pavilion principle were the Judiciary Square and Mount Pleasant Hospitals, Washington. They had a central corridor and five pavilions on each side; the pavilions were 248 feet long, and were divided by transverse partitions into four wards; later the length of the building was reduced to 150 feet, the width of the wards being 24 to 25 feet, and height 12 to 14 feet. The experience of the war was in favour of the pavilion system. None of the special hospitals constructed in the Civil War was in existence when the United States entered the World War; in April, 1917, there were 131 post hospitals, four general hospitals, and five base hospitals. The post hospitals were usually small, and the buildings were crowded together; the general hospitals were enlarged post hospitals, and had similar defects, but had better provision of medical and surgical appliances. In July, 1917, when a hospital division was created in the Surgeon-General's office at Washington, plans were prepared for hospitals in the mobilization camps in the United States, and for hospitals in which the sick and wounded from overseas would be treated. Hospitals were provided at ports in which it was anticipated the patients would stay not longer than ten days, being then cleared to general hospitals provided by leasing civil hospitals, hotels, colleges, etc., in large towns, mainly in the East, as large civilian properties

suitable for conversion into 1,000 bed hospitals did not exist in the West. A few new general hospitals were constructed, and particularly for tuberculous patients; these hospitals were placed in the mountains of North Carolina and the high and dry sections of Colorado, New Mexico and Arizona. In preparing the designs for overseas' sick and wounded, arrangements were made for eighty per cent ambulatory patients, but these proved to be from ninety to ninety-five per cent. In camp hospitals it was found that from sixty to seventy-five per cent could use the mess rooms. In each 1,000 bed hospitals twenty beds were provided for the observation and treatment of mental cases, and fifteen per cent of these were required for the violently insane. Approximately eight per cent of the hospital accommodation in camps was designed for the isolation of cases of communicable disease. It was estimated that hospital beds would be required for seven per cent of the troops overseas, but as a turnover every six months was anticipated, the actual provision was three and half per cent.

Block plans of the various temporary hospitals are shown in Chapter II, and plan B, fig. 13, was used for the thirty-two hospitals of the National Army and National Guard camps, and for several other hospitals of 1,000 beds erected soon afterwards. The plan is very similar to that of the general hospitals erected in England during the early days of the war. The administration and receiving block are in the centre in front; the surgical and laboratory blocks behind these, and the dining rooms at the back; the ward blocks are arranged in rows on each side; all the blocks are connected by an enclosed corridor. Block plan C was used when shortage of materials was beginning to be acutely felt; the corridor construction was minimized in this plan.

As regards the individual blocks, considerable changes were made later in the administration and receiving blocks; these were enlarged and facilities were made for the observation of cases of suspected communicable disease, and the dispensary was placed in the same building. Wards were designed for the treatment of four classes of patients, viz., general, tuberculous, contagious and mental. The general ward blocks were mainly of two types: the one-storey single or double ward and the two-storey ward barracks. The one-storey single ward had a solarium at one end and was connected with the corridor at the other end, where were situated bath, w.c.'s lavatory, utility room (slop sinks) a quiet room, kitchen, linen and nurses' office. A covered porch ran along one side of the ward and opened into the connecting corridor. A window was placed between every two beds and there was a door opening into the "solarium" and one about the middle of the ward opening into the covered porch. There was also a door opening directly from the ward into the compartment containing the w.c.'s. We prefer the British system in which w.c.'s, slop sinks, etc., are cut off from the ward by a ventilated passage. In a better design the number of beds was reduced from thirty-two to twenty-eight and three quiet rooms, (special case wards) were provided. In this design the door from the ward

opened into the bath room; the w.c.'s and utility room were placed farther away from the ward and their doors opened into the ward passage; there were also three double doors opening from the ward into the covered porch. The two-storey ward barracks had on each floor two wards each of fourteen beds; the centre of the block was occupied by a large day room, four quiet rooms and two toilet rooms. The second storey of similar construction was reached by a staircase placed at each end of the covered porch. It was the rule to provide not less than 800 cubic feet of air space per bed and a minimum spacing between beds of three to three and a half feet. The floor area per bed varied from seventy to eighty-five square feet. In computing air space height above twelve feet from floor to ceiling was disregarded. Experience in locating buildings on various sites showed that a length of 150 to 180 feet was the maximum possible for a ward block. The window area was usually twelve per cent of the floor area, but in ward barracks the percentage was about nineteen. In addition to sliding sash windows ventilation was arranged for by ridge ventilators. In the earlier designs water-closets were placed in stalls but in the later designs the partitions were omitted. Laboratories were supplied with hot and cold water at first, but later wash-trays were provided so as to permit washing under a running tepid stream. One tub with hot and cold water was installed for each ward. Urinals were provided in the proportion of one to twenty-five beds.

The tuberculosis wards were of two types (a) the infirmary, (b) the ambulatory or fresh air ward. The infirmary was used for patients confined to bed; it was well heated, but had easy access to porches. The ambulatory ward proper was not heated and was open along the whole side in front, it faced south, the open side was fitted with curtains or swinging partitions of various designs, but none was found satisfactory.

Laboratories were at first erected quite apart from the mortuary and animal house, but in later designs these were all placed in one building. The mortuary, viewing rooms, office, store room, and animal rooms were on the first floor and the chemical and bacteriological rooms on the second floor. The rooms in which the animals lived were separated from the other rooms on the first floor by a ventilated passage.

The original surgical building built for the National Army and National Guard hospitals had a clean operation room at one end and a so-called pus dressing room at the other end, between these rooms were placed an etherizing room, sterilizing room, instrument room, surgeon's rooms and nurse's room. The eye, ear and dental clinics were in a separate building. In later designs for a hospital of 1,000 beds, the rooms for general surgery and head surgery and also eight quiet rooms, X-ray rooms, recovery rooms and toilet rooms were placed in one building. Fig. 31 shows the complete design of the surgical department for a hospital of 1,000 beds. In the design for a hospital of 2,000 beds there are six operating rooms, three in the clean operating department and three in the pus operating department.

The importance of good cooking and good serving of food was early recognized, and fig. 35 illustrates the kitchen and messroom provided in the large camp hospitals during the first summer of the war. There was a main kitchen, a diet kitchen, a vegetable preparation room, a butcher's room with attached refrigerators for meat and dairy produce, a buttery and bread storage room and a food-cart room. Separate kitchens were provided for officers, nurses and detachment men. In later designs provision was made to cook the food for patients and staff in one kitchen. In 1918 kitchens and messrooms for large hospitals of 2,000 beds were developed; the typical design included a preparation room, kitchen and a double mess hall, and the wash-up was opposite the "cafeteria" counter in each mess room, thus reducing the carriage of crockery, &c., to a minimum.

On November 11, 1918, there were in the United States excluding hospitals of small size and camp hospitals, 92 large hospitals containing a total of 120,916 beds, and additions authorized which would have furnished a total of 147,636 beds.

The Staff for a hospital of 1,000 beds was one Colonel or Lieutenant-Colonel, 4 Majors, 30 Captains or Lieutenants, 400 enlisted men, 100 nurses.

One section of the book is devoted to the organization, administration and control of hospitals. A chapter deals with the differentiation of general base and camp hospitals. Military reasons were predominant in the location and character of hospitals which could be arranged in two groups, viz., those for service in the United States and those for the theatre of operations. There were camp hospitals and general hospitals in the first group and base hospitals for the line of communication of the theatre of operations. Another chapter of this section also gives details of the organization of the personnel and of the system of instruction adopted for officers, nurses and enlisted personnel. The scheme of instruction for officers is given in great detail and was very comprehensive; supplies and utilities are dealt with in another chapter. The medical department was charged with the furnishing of medical and hospital supplies. A mess officer was responsible for the diets, and supplies were obtained from the Quartermaster Corps or purchased locally. The transportation of sick and wounded from ports to hospitals is described in Chapter XII and details of the construction of hospital trains are given. Glennan adjustable bunks were fitted for the carriage of patients.

The remaining three sections of the book deal with the description of various hospitals in the United States. The hospital in Camp Grant, Ill., is selected for description as the type of a base hospital. Permanent general hospitals are represented by the Walter Reed general hospital, Washington, D.C., converted general hospitals by No. 2 Fort, McHenry, Baltimore, and the general hospital for tuberculosis by No. 21, Denver, Colo. In the chapter following the account of aviation hospitals there is a description of the "airplane ambulance" which was found very useful in bringing

patients from flying grounds, often difficult of access for ordinary motor transport. There are some excellent photographs of the Winching Stokes litter placed in the Rockwell field airplane ambulance, and of the Stokes litter in a D.H.-4 airplane ambulance. The remaining chapters of the volume deal with embarkation and debarkation hospitals and other general hospitals in the United States. These hospitals were formed in many cases by structural alterations to hotels and other large buildings.

From what we have written it will be realized that this volume is likely to be of great use to all medical officers, and especially to those who are charged with the erection and management of hospitals generally. The plans in the first part of the volume are worthy of careful study, and the descriptions of the hospitals actually occupied in the United States are given in such detail that medical officers will find guidance in any difficulty likely to arise in this domain of war work.

THE FIGHTING FORCES. A Quarterly Magazine for the Royal Navy, The Army, and The Royal Air Force. Gale and Polden. Price 5s.

We heartily welcome this latest addition to the military journals, the second number of which has been sent to us for review. It contains twenty-one well-written entertaining articles, amongst which officers of the fighting services will find something of special interest. Current naval and military problems are discussed in thoughtful and instructive articles. The Singapore controversy is ably dealt with in two papers, viz., "Some aspects of Naval Bases and Hawaii, the West Indies and Singapore." A plea for the establishment of an Empire Airship Service to carry passengers and mails in ordinary commerce, and for naval airships to be used for patrolling the oceans instead of cruisers is well argued. A lucid statement on "The Cut in Pay" is particularly appropriate at the present time. An article on "The Influence of James II. on the Navy" will be of interest to naval historians. Cavalry men generally and Indian Army officers will be interested in articles on "The French Cavalry Doctrine of To-day" and "The Indian Frontier and the Indian Army."

Retired officers and those about to retire will find useful information in "When the Harness is Unbuckled." We mention a few articles to indicate the scope of the magazine, but all are good and pleasant reading.

A. E. H.

MODERN ASPECTS OF SYPHILIS. By M. J. Horgan, B.A., M.B., B.Ch. B.A.O., N.U.I., late Resident Medical Officer General Dispensary, Nottingham. London: Henry Frowde and Hodder and Stoughton. Pp. xii. + 136. Price 5s. net.

This book has a foreword by E. Finger, of Vienna, in which he states that it contains a concise embodiment of the views held at the Finger Clinic on the pathology and therapy of syphilis. Great stress is laid on the value of examination of the cerebrospinal fluid, which is designated in this volume "liquor." The importance of such examination though perhaps not fully appreciated either in this country or on the Continent is

emphasized in "Schemes of Treatment recommended for Patients suffering from Syphilis." W.O. pamphlet 1920.

The book is more than an elementary manual of syphilis, and for those engaged in the treatment of this disease it contains much useful information which, although not all new, is given simply and in a new light.

The chapter on non-specific therapy contains several new ideas on treatment. The injection of milk, of *mirion* (di-iodi hexamine gelatinate), and of malarious blood are described—the last-mentioned is used by Kryle for early syphilis as well as for general paralysis. These methods are not likely to come into general use.

In the chapter on specific therapy little detail is given of the actual treatment by the arsenical salts, and bismuth, which in this country has almost superseded mercury, is not mentioned.

On page 89 the most common method of treatment of syphilis in England is wrongly described as "two courses of salvarsan and mercury with nine weeks' treatment with iodide of potash." In early syphilis no course of treatment has more than two weeks under iodide therapy.

In the appendix useful information is given on the examination of the cerebrospinal fluid. Meinicke's Third Modification is described fully and Meinicke's "T.R." Method is given rather vaguely.

The statement on page 108 that a gold sol rapidly throws down gold and that only sufficient should be made for current use does not agree with the statement on page 109 that a gold sol keeps in good condition for a month or six weeks.

We do not agree with the advice to wash out tubes for the Lange's test with nitric and hydrochloric acids, as the difficulty of removing absorbed traces of these acids from the glass may lead to error in this extremely sensitive test.

The Mastic test is not described, so presumably is not used in Finger's Clinic.

The book is recommended to those interested in the diagnosis and treatment of syphilis as controlled by cerebrospinal fluid examination.

THE CULTURE OF THE ABDOMEN, THE CURE OF OBESITY AND CONSTIPATION. By F. A. Hornibrook, with a preface by Sir W. Arbuthnot Lane, Bart., C.B., M.S. London: William Heinemann, Ltd. 1924, Pp. xi + 67. Price 6s.

This excellent little book explains in simple and forceful language why we should give a few moments consideration daily to the culture of a much neglected portion of our anatomy—the abdomen, if we wish to possess health and to avoid two of the commonest ailments of civilization viz., obesity and constipation.

We are told in Part I how important it is attend to our internal hygiene by encouraging natural sanitary principles—eat suitable food in moderate amount and not too frequently; avoid the use of potent purgatives by regular doses of paraffin until the muscular tone of the abdominal wall and

of the intestines has been brought to normal by suitable exercises which are described later.

Great stress is laid on the necessity for adopting a correct posture, which can be acquired by frequent attention until it becomes automatic without conscious effort.

One must protest here against the totally incorrect description and photograph in Chapter III said to represent the military position of attention which is held up to ridicule.

The military position of attention is clearly defined and illustrated in the "Manual of Physical Training" (1908), para 1, where common faults are also pointed out; the author has carefully described an incorrect position of attention as that normally taught and adopted by the soldier, a grievous injustice which he persists in throughout the book.

Sound advice is given on the value of drinking liberal quantities of water between meals and on rising in the morning; I can testify to this simple remedy for the cure of many cases of constipation. Part II is devoted to simple rules of exercise, followed by a very short description of the system of exercises that is intended to increase the tone of the abdominal wall and the involuntary muscles of the intestines.

The exercises described as "Hammock Swing," "Tensing and Retracting," and "Pumping," are new in conception and can be beneficially performed irrespective of age, sex or strength; they certainly increase the peristalsis of the intestines remarkably.

The "Lateral Press" exercise is not so satisfactory as the ordinary "Trunk Rolling" exercise, while two called "Retraction and Recoil" and "Hip Roll" appear to be of no value, the former is difficult to perform and unsatisfactory, and the latter is absurd, as it bears no relation to the culture of the abdomen.

The author has undoubtedly written this little book for the public to whom it should be of the greatest service in maintaining health and postponing old age.

W. B. S.

Correspondence.

THE SOLUTION OF WAR PROBLEMS BY CORRESPONDENCE.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—Major H. S. Blackmore's letter is inspiring. Many others may feel also that much can be accomplished through the "correspondence" idea.

After a good, long *post-bellum* rest (and a good, long *p.b.* grouse) we are awakening to new responsibilities that are, in effect, our *raison d'être*, the study of future war problems: *Esprit de corps* with us is more intense than is realized.

Our future potentialities, properly developed, are great. The applica-

tion of medical science to armies is as revolutionizing as the advent of tanks and gas. Numbers will tell in the long run in future wars, whether these numbers refer to specialist fighters or to whole nations in arms; *it is the application of medical science to war that can ensure maximum numbers.*

Some day high commands will recognize this. Some day there must come about a medical *risorgimento* which will eventually carry us forward into new spheres of military usefulness. *Let us hasten the advent of this day.*

An army can train itself only according to a definite doctrine, as it can equip and organize itself only according to a definite policy. In neither case can it stray far from the beaten path of experience. On the other hand, opinions and conceptions held by individual officers can range far ahead of official doctrine and policy. As opinions and conceptions become solidified and generally accepted after due consideration, they can be incorporated into doctrine and policy.

While it is the first duty of the officer to *obey*, during this strange *post-bellum* epoch there is another duty, and that is to *think*. What is wanted from us now is mental skirmishing into the unknown and undetermined, in order that the army may benefit from our mental activities.

I suggest to junior majors and to captains that those of us who feel so disposed should develop the correspondence idea by forming ourselves into a "circle of medical officers." It could be worked up quite easily. We could soon get out notes and memoranda on matters connected with field service problems, promotion examinations, references to books and regulations dealing with these subjects, information regarding study for additional degrees and qualifications, and similar matters of professional and administrative importance.

The circle must be irrespective of rank, quite unofficial, and completely side-tracked and segregated from all questions of pay, promotion, pensions, and any ventilation of grievances. If it could be got into operation on a small scale, let us hope that this Journal will assist us later by the publication of our notes and memoranda.

In this way we might assist each other in the study of war medical problems, foster interest in this and other subjects, develop administrative character, and initiate a cult of military medical "highbrowism"; all this will tend towards higher standards of medical and military efficiency.

The science of medicine in relation to the art of war has now reached a stage at which application of known medical facts to army conditions is the urgent requirement. New discoveries will simplify preventive measures, but to-day we know almost sufficient about the spread of military diseases to change our conception of disease prevention into disease eradication; *where we fail is in the practical application of our knowledge.*

Take malaria, for example. With the exception of a few casual cases, need there be malaria in the British Army under peace conditions? Have Ross and the others not told us sufficient to eradicate this disease—or are

their labours to be fruitless, their teachings ignored, because we cannot have these applied effectively to garrison life?

On various sectors of the disease front success has been registered, but in most cases this success is partial. With diseases such as undulant fever and the enteric group, however, our standards have been carried to victory, and the natural tendency is to extol complete success and ignore partial failure. This must be counteracted.

If we care to look around the various items of medical work in war, we can see at a glance how vast is the task that will have to be tackled some day. For example, the sheet anchor of incineration will not hold; war in the air throws this method of refuse disposal on its own scrap-heap. A substitute will have to be found. Then chlorination of water, sound in principle, is far from fool-proof in practice. Much work requires to be done before this is going to be a universally safe method of providing the small, mobile field unit with water that is above suspicion. Here again it is practical application that is required. Original thought and fresh ideas will find wide scope in medical organization for war; the motorization of medical units, the creation of a really mobile unit that can deal with major surgery in the forward area—above all, the study of gas warfare—are examples of what requires to be done. *Everywhere and at every point work awaits us.*

An unofficial circle can probably accomplish more under present conditions than official teachings. What is first wanted is the stimulation of interest, the development of higher conceptions, and the construction of new view-points. Even if many ideas are ragged and fantastic, others may evolve on more polished and practical lines. It is better to hold views that may be slightly warped and exaggerated than to possess no opinions at all.

If anyone feels interested enough to assist in the launching of a "circle of medical officers," or any other name one cares to call it, I shall be grateful if he will communicate with me.

It is high time to be up and doing. Let us get a move on.

*Military Hospital,
Imtarfa, Malta.*

I am, etc.,
M. B. H. RITCHIE.

PROGRESSIVE ULCERATION OF THE SKIN ASSOCIATED WITH A DIPHTHEROID BACILLUS.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—In connexion with the above case reported by Lieutenant-Colonel H. Marrian Perry in the May number of the Journal, reference is invited to a "Note on a Bacillus Occurring in Some Intractable Venereal Ulcers," appearing in Vol. xix, published in September, 1912.

*The Army School of Hygiene,
Puckridge Hill, Aldershot.
July 7, 1924.*

I am, etc.,
C. H. H. HAROLD,
Major.

Notices.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc. He will also be glad to receive items of news and information regarding matters of interest to the Corps from the various garrisons, districts, and commands at home and abroad.

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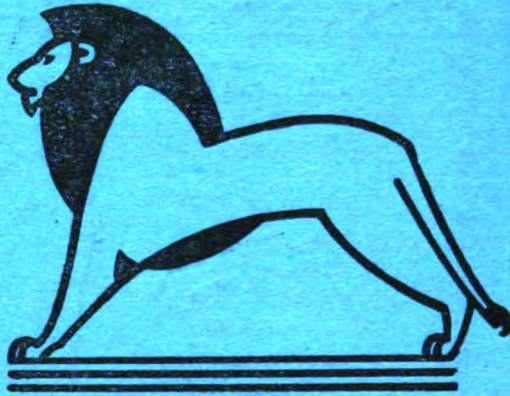
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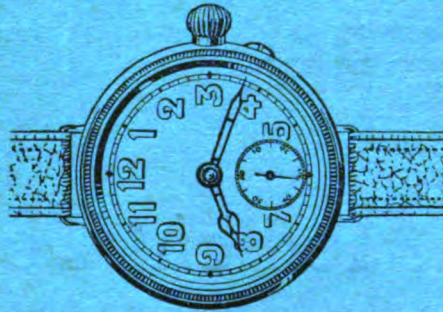
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SCHISTOSOMIASIS AND SPLENOMEGALY IN CENTRAL AFRICA.

BY CAPTAIN WILLIAM H. DYE,
Royal Army Medical Corps.

TOPOGRAPHICAL.

THE area of country over which these investigations were conducted is situated at the northernmost part of British Nyasaland, being adjacent to Tanganyika Territory in the north and to Northern Rhodesia in the west. The eastern boundary is formed by Lake Nyasa.

The topography of this part of Africa is extremely varied, but can be roughly divided into a lake shore level area, a narrow strip in no place more than ten miles wide, and a mountainous hinterland composed of plateaus, broken hills and valleys. As Lake Nyasa is 1,600 feet above sea level the humidity of the atmosphere is not excessive, except during the rains, which last about four months, with an average rainfall of fifty to sixty inches.

The vast majority of the population (Wankondies) inhabit a small area about twelve miles in length along the lake shore, and nine miles deep. This surrounds the Karonga station, a District Magistrate's post, and is very fertile, being watered by four rivers containing water all the year round. As there are about 25,000 men, women and children in this limited space, the villages are very crowded together, in contradistinction to the remainder of the district, which is but sparsely populated. During the rains, the rivers, owing to the mountainous hinterland in which they rise, contain a great deal of water, and overflow their banks in many places, creating temporary marshes. The villages are built on any spot slightly elevated a foot or so, but are completely isolated by water for months on end, the footpaths being knee-deep in water (figs. 1 and 2).

All species of molluscs indigenous to the country can be found in these pools.

Close to the lake shore there are other and more permanent pools due to the lake throwing up a ridge of sand. These pools, which lie parallel to the lake, extend far back in the rains, but are of comparatively small



FIG. 1.



FIG. 2.

extent at the end of the dry season. They are full of dense vegetation, and the paths leading from the villages, situated on the high ground behind the lake, pass through them. These paths are used daily by the natives when fetching drinking water and when going to bathe (fig. 3).

During the rains when rivers overflow and innumerable small streams

come into existence, fish traps are placed here to catch the small fry which take refuge in the more shallow water. These traps are very convenient places for finding the smaller species of fresh-water molluscs.

As the country is extremely varied it is impossible to describe the hinterland in detail, but usually the water is confined to swiftly running mountain streams, or is dug for out of dry river beds, which only hold water at the height of the rains. Bathing is not indulged in by the inhabitants of these highlands owing to the cold or scarcity of water, and they are therefore indescribably dirty, in contradistinction to the natives living on the lake shore level strip who bathe at least once a day. The country has been described, for, as will be seen later, it has a practical bearing on the relationship between the splenomegaly found there, and bilharzia.



FIG. 3.

INTERMEDIATE HOSTS OF SCHISTOSOMA.

The following species of molluscs are indigenous to this part of Africa:—

- (1) *Lanistes affinis* Smith.
- (2) *Vivipara robertsoni* Frauenfeld.
- (3) *Limnæa natalensis* Krause.
- (4) *Physopsis globosa* Morelet.
- (5) *Melania nodocincta* Dohrn.
- (6) *Isidora forskali* Ehrenberg.
- (7) *Planorbis* sp. near *Sudanicus* Martens.

(a) *Schistosoma mansoni*. Owing to the prevalence of this form of the disease, ample material was available. All species of molluscs were repeatedly exposed to infection and examined at periods of one, two, three, four, five, six, seven and eight weeks after exposure, by crushing the shells and teasing out the body.

One species only, *Planorbis* near *Sudanicus*, was found to become infected with typical fork-tailed cercaria. A hundred per cent showed infection with cercaria on the twenty-fifth day, but did not shed them until the twenty-eighth day. The maximum time it was found possible to keep infected snails alive was one hundred days, and they were shedding cercaria up to the last. Owing to the fact that so many molluscs were found to be naturally infected with cercaria of many types, molluscs of this species were bred in the laboratory through two generations, and when half grown were exposed to infection with successful results. Owing to the lack of apparatus certain difficulties had to be overcome. Of these the chief was the difficulty in keeping the water sweet in the small jars available without repeated changes, which is essential for breeding purposes. It was found that even with a layer of clean washed sand at the bottom of the jar, and clean reed stalks as vegetation, the water would be offensive in three days, and the snails would die. This was eventually overcome by preparing the jars beforehand by filling them with water containing a large quantity of the green growth found floating on the surface of stagnant pools. If left untouched for a fortnight, it was found, on pouring the water off, that the inside of the jars were covered with a green growth, and jars thus prepared would afterwards remain sweet for as long as three months without changing the water, even when crowded with snails.

It was also found advisable when infecting the intermediate hosts, either with urine or faecal matter, to change the water as soon as time had been given for all the eggs to hatch out, as this contamination in a confined space would, if left, cause the death of the molluscs. In the case of *Schistosoma haematobium*, the eggs of which hatch rapidly, the water can be changed in a few hours after infection, but with *S. mansoni* at least twenty-four hours should be given, as even if the faecal matter is broken up before adding it to the aquarium jar, the eggs of this species were found to take a much longer time to hatch, often up to twelve hours.

All the other species of molluscs, although repeatedly exposed to heavy infections, proved consistently negative. Therefore I think it may be said definitely that this is the only intermediate host of *S. mansoni* to be found in this particular part of Africa.

S. haematobium: Many difficulties were encountered in finding the intermediate host of this species of fluke. *M. nodocincta* was not found for some time, its habitat being the mud lying at the bottom of the reedy pools. None was ever found visible in the day time, they most probably come to the surface of the vegetation at night, and very likely during the day in the darkness of the reeds. In the laboratory they bury themselves in the mud for long periods, but are often found near the surface early in the morning, and if the jar is kept covered they may remain up for long periods.

Both *P. globosa* and *M. nodocincta* appeared to be attractive to the miracidia, but contrary to expectations the latter appeared far and away

more attractive. Later it was found impossible to infect successfully *P. globosa*, while *M. nodocincta* would show typical fork-tailed cercaria without eye spots or pharynx at the end of twenty-eight days.

For a long time very puzzling and variable results were obtained with this mollusc, and great care had to be exercised as they were frequently found to be naturally infected with single-tailed cercaria. This latter fact appeared to be the cause of the variable results so often found. It was proved that if they were naturally infected with this unknown cercaria it was impossible to reinfect them with *Schistosoma*, although a very heavy mortality occurred whenever it was attempted. On the other hand, if not already infected, a successful result could be obtained, if the number of ova added to the aquarium jar was carefully graduated, as an over infection would kill off this species of mollusc very quickly.

All the other species, including *Planorbis* sp. near *Sudanicus* proved negative to repeated experiments.

As I feel confident that the above list of fresh-water molluscs embraces all the species that are indigenous to the stagnant pools in this part of the world, I think it is safe to say that the natural intermediate host of *S. hæmatobium* is *M. nodocincta*. Owing to the difficulty in finding this species, time did not allow of any breeding experiments with it, as my tour of service had come to an end.

METHODS OF NATURAL INFECTION OF THE HOST, ETC.

Both the vesical and the intestinal form of schistosomiasis are very common in the people living close to the lake shore already described. But for a long time it was very puzzling why they should suffer so lightly from the vesical form and so severely, especially the children, from the intestinal, which latter causes a heavy mortality.

The points which soon became obvious when working on this condition were:—

- (1) The severity of the intestinal form in children and young adults.
- (2) The comparative rarity of a severe infection in full-grown adults, although lateral-spined eggs were extremely common in their fæces.
- (3) The absence of any complications in the vesical form, either in children or adults, thereby presupposing only a light infection.

The explanation of this appears to be twofold, lying partly in environment, and partly in the difference in the habits of the two species of blood fluke involved.

The sanitary habit of the adult native is to arise at dawn and wander into a sheltered place to defæcate, usually going fairly far afield if the village is a large one, as they are liable to various complicated penalties if they should view by accident a senior relative performing his natural offices. This is still largely, if not universally done, in spite of the system of pit latrines introduced, the use of which is honoured more in the breach

than in the observance. On the other hand, the small children, that is those who are big enough to run about, defæcate at any time of the day when nature calls, and in the villages lying adjacent to the lake-shore the afore-mentioned reedy pools afford excellent natural cover near at hand, as the little children are too timorous to venture far afield. The latter places are naturally avoided by the adults, as they are cold and damp in the early morning. Close examination of these areas has shown proof of this.

An infected child can therefore infect a good number of molluscs at one time, and when at the end of twenty-eight days these are shedding cercaria in large quantities, if the child continues to use the same place with any regularity, a most probable conjecture, it can easily be seen that he establishes a vicious circle increasing in intensity daily. Only by this means is it possible to account for the enormous number of adult flukes found in one of these cases.

On the other hand an adult most probably only gets infected occasionally, especially when working on the fish traps, as walking through these pools as they do daily in going to the lake does not give much opportunity to the cercaria to get attached, as their swimming powers are limited, and experimentally they are easily displaced by any vigorous movement of the water.

This will explain the heaviness of the infection in children with the intestinal form, but the comparative lightness of infection in all ages with the vesical form appears to have an entirely different explanation.

While experimenting with the eggs and miracidia of these parasites it was found that, while the eggs of *S. hæmatobium* hatched rapidly when the urine was diluted with a large quantity of water, the vast majority of the eggs being hatched in half an hour, on the other hand the eggs of *S. mansoni* took a much longer time to develop, any period between twelve and twenty-four hours being necessary. As it is so often noticed, urine examined immediately after being passed always contains a very large proportion of eggs showing active embryos and occasionally a hatched miracidia. On the other hand, the ova of the lateral-spined eggs in the fæces are invariably motionless.

If, as Khalil has pointed out, hatching is due to the osmotic pressure of the fluid in which the eggs lie, a 0.75 per cent NaCl sol. completely preventing hatching, this would explain the difference. (See appendix to this paper.)

Further it was noticed that if a portion of infected fæces was placed in a Petri dish and well diluted with water, when the eggs hatched out the miracidia very quickly disappeared if the proper intermediate host was present. On the other hand it was found that when heavily infected urine was diluted in a dish, the miracidia as usual hatched out rapidly, but for some period travelled actively about the dish, and not until they had roamed about for fifteen to twenty minutes did they take any notice of the intermediate host. At the end of that time the miracidia would start to

swarm, and very quickly they all would have collected round it in a remarkable manner.

It thus appears that the miracidia of *S. hæmatobium*, in contradistinction to those of *S. mansoni*, and possibly on account of their greater numbers, do not immediately enter the nearest intermediate host, but first travel further afield. Very probably nature's prevention of over infection of any individual mollusc with the subsequent death of both snail and parasite.

Applying these facts to the problem presented, it can be easily understood why the children using one particular spot for defæcation, even if they pass their urine at the same time, are much more liable to reinfect themselves with the intestinal form than with the vesical.

TYPES AND COMPLICATIONS OF SCHISTOSOMIASIS PREVALENT.

(a) *The intestinal form.*—Leys (1917) reported a disease characterized by extensive enlargement of the liver, and very common to the earlier years of life. He describes it in some detail and suggests the possibility of kala-azar, but admits that the parasites could not be demonstrated, and that the blood picture is different. He also mentions a splenic enlargement which he associates with this condition. This splenomegaly is described by Castellani and Chalmers (1919) under the name "Wenku."

On my arrival in the district I was particularly struck by the large number of young natives with palpable and often visible enlargement of the liver, it being frequently enormous, and later I found that the incidence varied from village to village, some showing an index as high as seventy-five per cent.

Massive enlargement of the spleen was also seen though not quite so frequently, and this latter was, with very rare exception, always associated with some degree of hepatic enlargement.

The disease is well known to the natives, who term the general abdominal enlargement "Likuru" (= that which makes big), while if the spleen is visible to the naked eye, as is frequently the case when the enlargement is excessive, they use the term "Wenku" (= spleen, the spleen of the cattle being called by this name). They consider the condition favourable as long as the abdominal swelling is not excessive and no wasting has started. On the other hand, if the abdominal protuberance is very marked or wasting has started, they state they expect the child to die. In this they are most probably correct. They have no knowledge of the causation of the disease, other than it is due to the machinations of some enemy, and the native treatment, which appears valueless, is so bound up with witchcraft as to be impossible of elucidation by a European.

This peculiar enlargement of the liver and spleen which will be described is far and away more frequently found in children and young adults, although occasionally typical cases were observed in older people.

The course of the disease can be roughly divided into three stages.

(1) *Early stage without symptoms.*

No obvious wasting and usually well nourished, the enlargement of the abdomen is very noticable and characteristic, the lower ribs tending to bulge out in opposition to the common pendulant abdomen of young children (fig. 4).

If the hepatic enlargement is very great the outline of the liver can be seen when the child is standing and is still more evident when recumbent. On palpation of the abdomen the liver is easily felt, as there is no tendency to abdominal rigidity and no tension. The surface is soft and smooth, the edge being most typical, smooth with a sharp margin under which it is quite easy to insert the fingers, often for a considerable distance. This border usually runs horizontally from the right side to about an inch beyond the middle line, when it runs up to meet the left costal border. This smooth border is deeply notched just to the right of the middle line (figs. 5 and 6). A distance of seventeen centimetres between the xiphoid junction and the lower border has been found. At this stage it is perfectly painless to palpation. The spleen may or may not show massive enlargement, but usually at this stage of the disease enlargement has already started. A moderate degree of enlargement is of course to be expected owing to the malarial state of the country. If massive enlargement is present, the spleen is characteristic, being hard and board like, fairly mobile and quite painless to palpation, although pain is often present on standing, most probably due to the weight of the organ. Figs. 7, 8 and 9 show the splenic enlargement in both children and adults.

Thickening of the colon is common. Anæmia during this stage is absent, and no œdema of the face or limbs or ascites is present. The temperature is normal, any small occasional rise of temperature was always found to yield at once to quinine in the cases kept in hospital for observation. The tongue usually shows a thin white fur, with clean tip and edges.

A long series of blood examinations were made from these early cases. The following is an average taken from a series of children between the ages of seven and twelve years.

Red cells	..	..	..	..	..	..	4,597,200
White cells	..	..	..	..	..	..	8,198
Polymorphonuclears	..	..	..	..	49	per cent	
Lymphocytes	..	..	..	..	29	"	
Mononuclears and transitionals	..	..	..	..	7	"	
Eosinophiles	..	..	..	..	14	"	But sometimes as
Basophiles	..	..	..	..	1	"	low as 1 per cent
Hæmoglobin = 90 per cent							

The degree of splenic enlargement did not appear to have any influence on the blood count.

Blood examinations proved of more value from a negative than from a positive point of view. Anæmia is obviously absent, which corresponds with the condition of the mucous membranes in these early cases. There



FIG. 4.



FIG. 5.



FIG. 6.



FIG. 7.

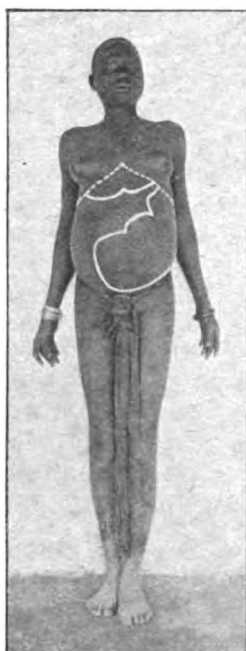


FIG. 8.



FIG. 9.

is a slight tendency to leucocytosis and eosinophilia is well marked, but as all these children have multiple helminth infection, especially hookworm, eosinophilia is of small diagnostic value. The mononuclears and transitionals are also increased, but here again the malarial state of the country is probably to blame. But in any case it would appear that the eosinophilia is so low and so variable as to be valueless as a guide to the result of treatment, as has been suggested.

Urine : No albumin was ever found in any of these cases.

Fæces : A large number of eggs of different helminths were always found. *S. mansoni* were constant, sometimes found in large numbers, sometimes but few. Next in frequency came rhabditiform embryos and eggs of *A. lumbricoides*, and then ancylostomes. Blood is sometimes present macroscopically, more frequently microscopically. A good proportion of cases appear to go no further than this stage and to recover eventually. They are rarely, if ever, brought to hospital for treatment of this stage of the disease, and if questioned, usually have no complaint or possibly slight epigastric pain. Some of the villages already described as lying close to the lake shore show a very high incidence of children in this stage, as high as seventy-five per cent being recorded in one village.

(2) *Early stage with symptoms.*

These cases are often brought to hospital for the marked abdominal protuberance, severe epigastric pain and wasting. Fig. 10 shows a case at this stage.

The child has a sickly worried expression, wishes to sit quiet, and does not play with the other children. They usually eat well, but in spite of this, wasting is progressive and rapid. Anæmia becomes evident, and is of the usual secondary type with no further increase of the eosinophiles. The liver, while still keeping its characteristic outline and shape, becomes harder, but remains painless to palpation. The massive enlargement of the spleen, if present, as it so frequently is, remains painless. No œdema is present at this stage. Temperature remains normal.

(3) *Late stage.*

This, the final stage of the disease, is marked by excessive wasting, great prostration, intense anæmia, and often great and tense protuberance of the abdomen. The tense protuberance of the abdominal wall, which however is a variable quantity, is in marked contrast to the flaccid wall of the earlier stages. Ascites with some, but usually slight, œdema of the lower limbs is present. Great epigastric pain is complained of, and an irregular temperature varying between 99° F. and 101° F. is present. This temperature is uninfluenced by quinine, but usually disappears a few days before death, when the temperature becomes subnormal. Death is associated with great pain and distress, the sufferer remaining conscious to within a short period of the end.

Figs. 11 and 12 show typical cases in the final stage.

The actual time the condition takes to reach this stage and the length of time the patient lives after this stage has set in are very difficult to determine, as these primitive negroes have no notion of time and very fleeting memories. But it appears certain that once this final stage has set in death is inevitable, and without treatment even the second stage will be fatal. As previously mentioned, it appears that a considerable number of cases never go beyond the first stage, but once wasting has set in, unless treatment is at once undertaken, it progresses to a fatal termination.

Following the study of a long series of cases it appeared probable on clinical grounds that the condition of the liver, at least, was due to *S. mansoni*



FIG. 10.



FIG. 11.



FIG. 12.

infection, the eggs of which were so consistently found in the fæces. Later opportunity occurred to perform a post-mortem on a girl aged about twelve years who died in hospital presenting all the typical signs and symptoms of the advanced stage. Unfortunately this particular case was one of the uncommon type presenting enlargement of the liver only, the spleen being only just palpable and not presenting the typical wooden consistency.

Examination had to be limited to the abdominal cavity as the extensive incision required to examine the thoracic organs would have been resented by the relatives, who only gave permission under pressure for the body to be opened, on condition that it should not be mutilated.

On section of the abdominal wall the liver was seen extending down

below the costal border, reaching as low as ten centimetres below the xiphoid junction in the middle line. A quantity of straw-coloured fluid (not measured) was in the peritoneal cavity, while the remainder of the abdominal contents appeared normal, no matting or thickening of the gut being found. The spleen was very slightly adherent to the adjacent organs but separated easily from these.

On removal the liver weighed $2\frac{1}{2}$ pounds and measured $6\frac{3}{4}$ inches vertically and 5 inches antero-posteriorly. The surface was pale and mottled, the mottling being due to bands of fibrous tissue. The surface, which had felt smooth to palpation, was in reality mammilated, the nodules

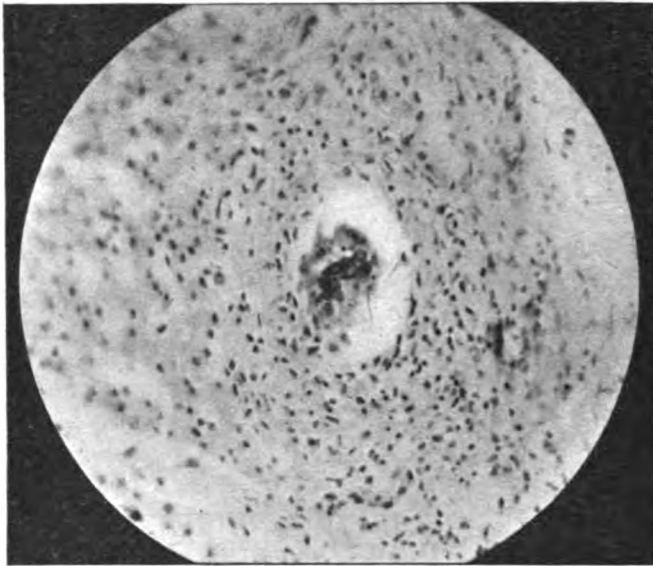


FIG. 13.—Collapsed egg of *S. mansoni* surrounded by early fibrous tissue formation. $\times 264$.

being soft and smooth, and about half an inch high and three-quarters of an inch in diameter. These naturally were impossible of detection by palpation through the abdominal wall. The characteristic sharp edge was very noticable. It will thus be seen that the enlargement of this organ was more apparent than real, only the vertical measurement being markedly increased.

Microscopic sections showed enormous numbers of lateral-spined eggs, in all stages. The older ones being much shrunk and embedded in fibrous tissue, while those more recently deposited were lying among the hepatic cells and surrounded by a small-celled infiltration (figs. 13 and 14). The lateral spines of these eggs could be easily demonstrated by focusing through a thick section. The capsule of Glisson was markedly thickened. The number of eggs in some sections was so great

as to have almost completely destroyed the hepatic cells, and it is apparently due to this fact that the final stage will not react to treatment, as the functional cells of the liver are too extensively destroyed. The portal vessels were full of mature flukes of both sexes.

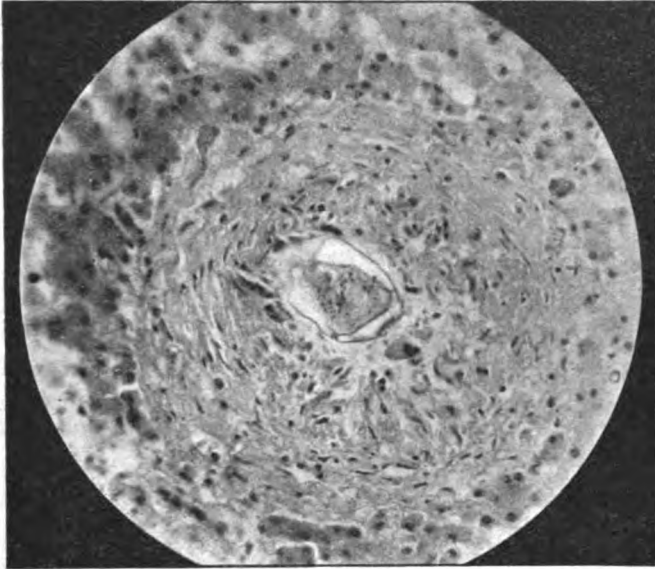


FIG. 14.—Later stage of condition seen in figure. $\times 264$.



$\times 2$
M. NODOCINCTA.

FIG. 15.

The spleen weighed seven ounces, was fairly friable with a deep red pulp, and no eggs were found in sections of this organ. The mucous membrane of the large gut was smooth and no polypi or ulceration could be

discovered. Microscopical examination showed large numbers of minute superficial hæmorrhages, and many eggs in the substance of the wall.

Careful examination of smears from the liver and spleen failed to demonstrate the existence of any other parasites.

It must not be concluded that all natives in this area have hepatic or splenic enlargement when infected with this species of blood fluke, as examination of healthy or apparently healthy natives frequently revealed the presence of the eggs. This complication appears to be, as already stated, commoner to the early years of life, and for the reasons already mentioned, that the children of both sexes are more liable to get reinfected repeatedly than the adults. Exceptions to this rule can however be frequently found, and in these cases the adults pass through the same stages as previously described, a fatal termination always ensuing when the third stage is reached. No difference in the sex incidence exists.

As regards the important question of the relationship of the massive enlargement of the spleen to the disease, it was unfortunate that no opportunity of doing a post-mortem on a case presenting this condition occurred, the only post-mortem available being the one described above, which presented hepatic enlargement only, and was therefore not of any value in settling this question. But after seeing a very large number of cases in all stages it appeared extremely probable that the splenomegaly was due to the same cause as the hepatic enlargement, for the following reasons.

It is very rare to find the typical massive enlargement of the spleen without some, and often extensive, enlargement of the liver as well. A study of the distribution shows that it is commoner to the people living in the lake shore villages already described, and is similar in every way in its distribution to the hepatic condition. Again, the clinical signs and blood examinations were always identical, but a point of some importance is that the degree of splenic enlargement was not in any proportion to the severity of the symptoms. This would naturally be expected, as the spleen is not of the same functional importance as the liver. Cases of extensive splenomegaly were observed over long periods and always found to be non-febrile, until the last and fatal stage of the disease was reached. Splenic puncture was always negative, and on insertion of the needle the substance of the organ appeared firm and sclerosed. It is not difficult to suppose that the irritation of a large number of eggs would, as in the case of the liver, cause a great deal of irritation, with the subsequent formation of fibrous tissue as was found in the liver, and, as already suggested, owing to the greater functional importance of the liver, the symptoms and severity of the condition would be in direct proportion to the amount of damage done to it.

It is not of course suggested that all recorded cases of tropical splenomegaly are due to infection with *S. mansoni*, although photos of some of the cases from Egypt are suggestive, associated as they are with hepatic enlargement. But I feel convinced that the cases present in this particular

part of Africa are entirely dependent on infection with this parasite. It is difficult to know whether this should be classed as a febrile or non-febrile form. As, however, a febrile reaction occurs only during the terminal stages of severe infections, it appears feasible to regard the disease as normally afebrile.

If the condition of the spleen was independent of schistosomiasis it would be reasonable to suppose that the villages lying at a distance from the lake shore, and which are not open to schistosoma infection, due to the lack of suitable breeding places, would show a number of these cases, as they are but a short distance away, and communication between them is easy and frequent. But the reverse of this was found to be the case on careful examination of these villages. The incidence was found to be absolutely dependent on the proximity of the breeding places of the intermediate hosts of the blood flukes. It might be argued that the proximity to these breeding places also means proximity to the breeding places of mosquitoes and that the condition might be due to an undiscovered parasite carried by a mosquito, or to repeated malarial infections, but this is negated by the fact that the villages lying away from the lake are also mosquito infected, but owing to the formation of the country these breeding places are never used by the natives as latrines, and in fact being usually in dense gullies, the natural hiding grounds of the larger carnivora, are left severely alone.

(b) *The vesical form.*—This, known locally as Lukojó, is looked upon by the natives as a very common and comparatively harmless complaint, and investigation of this condition did not yield any points of interest. It is extremely common, but as no sequelæ such as fistulæ, etc., were ever seen, it is reasonable to suppose that the infection is usually light. As previously described this appears partly due to native sanitary customs, and partly due to the different habits of the miracidia when seeking the intermediate host.

(c) *Mixed infections, etc.*—A dual infection with *S. hæmatobium* and *S. mansoni* was frequently met with, while it was not at all uncommon to find *S. hæmatobium* ova in the stools, and less frequently *S. mansoni* in the urine.

One boy with hæmaturia, in addition to ordinary terminal-spined ova, passed a number of ova of uncommon appearance. These had an elongated terminal spine about two-thirds the length of the egg. Some of them seemed to have in addition a second and much shorter spine, but this could not be demonstrated satisfactorily and may have been due to some optical effect.

TREATMENT.

Dr. Wilson, of the Livingstonia Mission, Central Africa, suggested to me the possibility of giving tartar emetic intrarectally (*British Medical Journal*, January 28, 1922). This was given an exhaustive trial, doses in excess of those advocated being eventually used. For a child of twelve the following dosage was employed:—

1st day	..	..	..	Purgative only
2nd	..	..	..	6 gr. tartar emetic
3rd	..	..	..	7 " "
4th	..	..	..	8 " "
5th	..	..	..	9 " "
6th	..	..	..	10 " "
7th	..	..	..	12 " "
8th	..	..	..	14 " "
9th	..	..	..	16 " "
10th	..	..	..	Rest
11th	..	..	..	16 gr. tartar emetic
12th	..	..	..	16 " "
13th	..	..	..	16 " "
14th	..	..	..	16 " "

It is obvious that these heroic doses are not absorbed in their entirety as no untoward symptoms were ever noticed. In the vesical form it frequently cleared the ova and the blood from the urine rapidly, only however to reappear in about a week. In the intestinal form I have given as many as three complete courses without making any improvement whatever, and in all cases improvement was only temporary. With much regret I had to abandon this method, as the convenience and ease of administration, especially in small children, made it most attractive.

The explanation of its action appears to be that, when given intra-rectally, it merely kills any adult flukes that may be in the bladder or rectal walls at the time of injection, and has little or no action on those situated at a distance. Better results might be anticipated in a very light infection, in which but few adult flukes, and those all in the same stage of development, were present. But all the cases treated were most probably suffering from multiple infections obtained at varying times.

Excellent results were, however, obtained with this drug when used intravenously. The dosage originally employed was too small, but on the advice of Dr. Christopherson this was increased with greatly improved results.

A one per cent solution of tartar emetic in sterilized water was used, beginning with two cubic centimetres and increasing the dose daily by one cubic centimetre until ten cubic centimetres was reached (ten cubic centimetres = 1.67 grains tartar emetic), and then a 10 cubic centimetre dose daily until a total of 174 cubic centimetres had been given (174 cubic centimetres = 29 grains tartar emetic).

Although in a district where reinfection is so highly probable it is difficult to differentiate between relapses and reinfections, a series of a hundred cases carefully chosen as least likely to be exposed to reinfection only showed fifteen positives at the end of twelve months. Taking the circumstances into consideration this appears quite satisfactory.

As regards the intestinal form complicated with hepatic and splenic enlargement, cases either in the first or second stages reacted well to the full course of treatment. Sufferers in the second stage improved markedly and put on weight, although careful measurement of the liver and spleen showed no diminution in bulk. The third or late stage, however, not only

showed no improvement, but did not tolerate the drug too well. It appears that if allowed to progress too far, the destruction of the liver tissue is too great to allow of recovery taking place.

It has been recently stated that a short course of tartar emetic, even if complete cure is not established, renders the patient for some time non-infective. That is, the ova passed while under treatment do not hatch, but exhibit a granular appearance. Observation over a large number of cases failed to demonstrate this. Ova are frequently passed until twenty grains of tartar emetic have been exhibited, and it has always been found that these hatch readily, and in the case of *S. mansoni*, they will infect snails experimentally. Reference to Experiment III in the appendix to this paper will show that the miracidia, when protected by their enveloping shell, are unaffected by being left in contact with an oversaturated solution of tartar emetic (four grains tartar emetic in two drachms of water), and on removal of the drug by washing the miracidia hatch out readily. Small granular eggs can always be found in any specimen of infected urine, but an increase in the number of these during treatment was never encountered.

CONCLUSION.

No difficulty was experienced in getting these primitive people to submit to intravenous injections. This may have been in part due to the fact that I originally started injecting them for yaws, the rapid and successful results of the 914 preparations being very evident to them. The difficulty in procuring enough needles is always a drawback in a distant station. Excellent results were, however, obtained with the platino-iridium type which, with care, were found to last for a considerable time.

Negroes undoubtedly stand larger doses of drugs than Europeans, and the above notes on treatment refer exclusively to natives. No opportunity of treating Europeans or Indians for this complaint occurred.

Negroes, even in childhood, usually have good veins, but occasionally difficulty was experienced, and some of the solution leaked round the vein. This was followed by a tense painful swelling which, however, quickly subsided without suppuration after the application of a few fomentations. Although, owing to difficult surroundings, the technique was not always perfect, no complications or untoward results ensued while using this drug over many thousands of injections.

Attached to this paper as an appendix will be found the details of some experiments designed to show the action of certain drugs on the ova, miracidia, and cercaria of *S. hamatobium*, in continuation of experiments performed by Khalil in Egypt. (*Proceedings of the Royal Society of Medicine*, 1922, vol. XV, pp. 13-15.)

My thanks are due to Dr. J. B. Christopherson for help and advice, and to Mr. G. C. Robson, of the British Museum (Natural History), for the identification of the molluscs.

APPENDIX.

Some interesting experiments were performed by Dr. Khalil of the Public Health Department, Cairo, in an attempt to prove whether tartar emetic had any lethal action on the ova of *Schistosoma* in the urine or in the tissues. The point is of some practical importance in relation to the question as to whether a non-curative course of this drug renders the sufferer non-contagious by killing the eggs while *in situ* or causing the adult flukes to produce granular eggs.

In his experiments he found that eggs, after remaining unhatched for four hours in tartar emetic, two grains in six cubic centimetres of water, were hatched normally on the addition of more water. He also found that sodium chloride and sodium sulphate would prevent hatching of the eggs in greater dilutions than the tartar emetic. From these results he drew the following conclusions: "(a) That the hatching of the bilharzia eggs is governed mainly, if not entirely, by the osmotic pressure of the fluid, subject to the physical laws of osmosis. The egg contents being practically isotonic with 0.43 per cent NaCl solution. (b) That tartar emetic as used in the experiments acts by virtue of being a salt and not as the specific drug that kills the bilharzia worms and their eggs inside the body."

The following experiments were performed to test these statements. In each case heavily infected material was used to enable definite conclusions to be drawn, and the controls were obtained from the same sample of urine as used in the experiment.

Experiment I.

Four drams of infected urine (one dram urine, three drams water) in each of three tubes, to which were added varying quantities of tartar emetic, and examined two hours and six hours after incubation.

	2 hours	6 hours
$\frac{1}{2}$ gr. tartar emetic ..	Eggs alive, sluggish; many miracidia, mostly dead, few sluggish	Eggs mostly dead, few sluggish; many miracidia, mostly dead; few sluggish
1 gr. tartar emetic ..	Eggs alive, sluggish; few miracidia, mostly dead, few sluggish	Eggs dead; few miracidia, all dead
2 gr. tartar emetic ..	Eggs mostly dead, few sluggish; few miracidia, all dead	Very few eggs, sluggish; few miracidia, all dead
Control	Few eggs, active; very many miracidia, all active	Very few eggs, sluggish; very many miracidia, some active, some sluggish

Compare with the following:—

Experiment II.

Two drams of infected urine (undiluted) in each of three tubes, to which were added various quantities of tartar emetic and left for two hours, and

then diluted with eight drams of water and examined one hour and four hours after incubation.

	1 hour	4 hours
$\frac{1}{2}$ gr. tartar emetic ..	Eggs alive, sluggish; many miracidia, most dead, few sluggish	Eggs mostly dead, few sluggish; many miracidia, all dead
1 gr. tartar emetic ..	Eggs alive, sluggish; many miracidia, all dead	Eggs chiefly dead, few sluggish; many miracidia, all dead
2 gr. tartar emetic ..	Eggs chiefly dead, few sluggish; few miracidia, all dead	Eggs dead; few miracidia, all dead
Control	Few eggs, mostly active; many miracidia, mostly active	Very few eggs, sluggish; many miracidia, some active, some sluggish

It will be noticed that while in Experiment II the same quantities of tartar emetic were added to two drams of undiluted urine as against four drams of diluted urine in Experiment I, thereby exposing the ova to a double concentration of the drug for two hours, the hatching, though more retarded, took place as readily as if the dilution had been done at once. It will be also noticed that in both experiments the concentration of tartar emetic in the solution was not enough to prevent a certain number of eggs hatching, although in Experiment II the strength of the third tube was as high as 1 in 60, a concentration impossible to obtain in the human body. On the other hand the miracidia once hatched were quickly destroyed.

Experiment III.

Two drams of infected urine (undiluted) in each of two tubes, to which were added four grains tartar emetic and left for two hours and examined. One tube was then diluted with eight drams water and examined one and four hours after dilution. The other tube was washed repeatedly in the centrifuge and the washed sediment diluted with a large volume of water and examined one and four hours after dilution.

	Before dilution	1 hour after	4 hours after
4 gr. tartar emetic (unwashed)	Eggs alive, active; no miracidia or empty membranes	Eggs, some dead, some sluggish; no empty membranes	Eggs mostly dead, some sluggish; miracidia all dead
4 gr. tartar emetic (washed)	Eggs alive, active; no miracidia or empty membranes	Eggs very active; many miracidia, mostly active	Very few eggs; large numbers of miracidia, mostly active
Control	Eggs alive, active; no miracidia or empty membranes	Eggs very active; many miracidia, very active	Very few eggs; large numbers of miracidia, mostly active

Although a higher concentration of tartar emetic was used than in either Experiment I or II, and left in contact for two hours on removal of

the drug by washing and then diluting with water, there was no difference between this tube and the control, vast numbers of miracidia being active at the end of four hours' dilution. In the unwashed tube the results were similar to those found in Experiments I and II, except that the ova appeared to suffer slightly more from the effects of the four grams than the two grams.

It thus appears that tartar emetic has no lethal action whatever on the unhatched miracidia, the shell membrane being an absolute protection. On the other hand the miracidia once hatched are readily killed if the concentration is high enough or even by a weak solution if left in contact for a sufficient time. The hatching is, however, retarded by this drug, and if in sufficient concentration it will prevent it altogether.

Experiment IV.

Experiments I and III were repeated, using a solution of NaCl in place of tartar emetic. The strengths used were 0.5 per cent, 0.75 per cent and 1 per cent. The results were identical inasmuch as hatching was retarded, but no lethal action was found to take place on the unhatched eggs. After washing away the salt, hatching took place readily, although a strength of 1 in 60 NaCl was used. It was, however, found that a lower concentration of this salt was required to produce the same effects.

Experiment V.

In this case a solution of perchloride of mercury was used in a concentration of 1 in 2,000. It was found that in this strength, while hatching was but slightly if at all retarded, the drug was almost immediately fatal to the miracidia, in marked contrast to the action of either tartar emetic or sodium chloride.

Experiment VI.

As a point of interest the action of tartar emetic on the cercaria of *S. hæmatobium* was tried.

Three tubes, each containing six drams of water swarming with cercaria, were used to which were added various quantities of tartar emetic and examined at the end of one, two, three, four and twenty-two hours.

	1 hour	2 hours	3 hours	4 hours	22 hours
$\frac{1}{2}$ gr. tartar emetic	Alive, active	Active	Active	Some dead, some active	Few active, most dead
1 gr. tartar emetic	Alive, active	Few active, most dead	All dead	—	—
2 gr. tartar emetic	Few active, sluggish; most dead	Few alive, sluggish; most dead	All dead	—	—
Control	Alive, active	Alive, active	Alive, active	Alive, active	Some dead, some active

This experiment should be compared with Experiment II, when it will be observed that the cercaria are more susceptible to the action of this drug than the miracidia.

Conclusions.

The following conclusions can be drawn from these experiments :—

(1) The hatching of the eggs is dependent on the osmotic pressure of the fluid in which the eggs are present, which is most probably, as suggested by Khalil, the reason why the eggs do not hatch out in the urine or the tissues of the body.

(2) The membrane or egg shell is complete protection to the contained miracidia, and therefore the unhatched egg is entirely unaffected by the action of any drug that can be injected into the human body. This would lead to the conclusion that only a complete curative course of tartar emetic would render a patient non-contagious.

(3) The various stages of the parasite resist the action of tartar emetic in the following order :—

- (a) The parent worm (from clinical evidence), least resistant.
- (b) The cercaria.
- (c) The miracidia.
- (d) The ova, most, if not completely resistant, to any percentage of this drug.

It will be noticed that the resistance to the action of drugs is in inverse ratio to the protected state in which the various stages of the parasite live in the natural state. That is; the adult fluke lives an almost completely protected existence, and is therefore the most easily attacked medicinally, while on the other hand the ova, which have to withstand considerable buffeting in the natural course of events, are very resistant to external influences.

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THE PRINCIPLES OF THE PROPHYLAXIS OF MALARIA :
WITH THE ADMINISTRATIVE AND OTHER MEASURES
FOR THEIR APPLICATION ON ACTIVE SERVICE.¹

BY CAPTAIN J. S. K. BOYD.

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(Continued from p. 100.)

DESTRUCTION OF MOSQUITO LARVÆ AND PUPE.

NEXT to be considered is the method which aims at the destruction of the developmental stage of the mosquito, a measure which has been conspicuous by its complete and brilliant success in some places and by its almost equally complete failure in others.

An example of success is to be found in the campaign which was conducted in Ismailia, a small town on one of the lakes through which the Suez Canal runs. This town was originally intended by De Lesseps to be the headquarters of the Suez Canal Company, and a port of no small magnitude. In order to bring to it an adequate supply of fresh water a canal from the Nile was constructed and opened in 1877. The supply of water from this was abundant, but unfortunately its drainage was not effectively controlled, so that marshes and pools of stagnant water sprang into existence, mosquitoes bred in swarms, and malaria became rampant. From that date until 1902 the disease flourished apace, providing as many as 2,500 cases in one year, and in inverse proportion the prosperity of the town waned, and it came to be regarded as a plague spot to be avoided at all costs.

In 1902 Ross was asked to advise the authorities, and mapped out a campaign based on the drainage of marshes, the filling up of pools, the canalization of streams to produce running water, and the treating of unremovable collections of water, such as cesspools, with kerosene. This proved so effective that in 1906 there were no fresh cases of malaria, and since that date the town has been relatively free from the disease.

In striking contrast is the state of affairs which obtained in Salonica from 1916-19. The possibility of the occurrence of an epidemic of malaria was foreseen, and in 1916, limited prophylactic measures were undertaken. In 1917 and 1918 vigorous and very extensive anti-mosquito measures were in full swing, but with such little effect that Wenyon, who was in charge of the Malaria Research Laboratory in Salonica, states that "in most places little or no good was done by attempted mosquito destruction" [18]. Statistics of the cases which occurred and the personal experience of all who studied the matter bear out the truth of this statement.

¹ "Parkes Memorial Prize Essay."

To reconcile these diverse results, neither of which is unique, the methods adopted must be taken into consideration. The theory of mosquito larva destruction is one of alluring simplicity. The impregnated female mosquito lays her eggs on the surface of water, and according to her species selects her particular kind of water, some preferring marshes and little stagnant pools of water, some wells, and some streams. Here in two or three days the eggs hatch into larvæ, which swim about feeding greedily, but which though they pass their lives in water must draw the oxygen they require from the air. In due course (from a few days to several months, according to the season of the year) the larvæ develop into pupæ, which are also aquatic and breathe in the same way, and these after undergoing further development give rise to the mature insect. The aquatic stage in the life history is the most suitable for the destruction *en masse*, for if water in a form suitable for the breeding of the mosquito can be abolished, no multiplication can take place and the insects will die out. Alternatively where this is not altogether practicable there is yet another line of attack in treating the water with chemicals. Thus if oil is spread on the surface of water the larvæ are unable to breathe through the film which forms and so are rapidly suffocated : or again, certain chemicals may be added to the water to kill the larvæ.

Unfortunately the simplicity of the theory is too often outshone by the complications encountered in its practice. The problem bristles with difficulties which may be so great as to throw the matter out of court on the ground of impracticability.

In the first place all anopheline mosquitoes are not carriers of the malaria parasite, and in the second place gross variations with regard to breeding habits are found among the different species of anophelines. Thus it often happens that in a mosquito-infested district where malaria is occurring, only a small proportion of the total mosquitoes are of the carrier type, and these may have quite specialized breeding habits, so that general measures of mosquito destruction might miss them altogether. The first essential in any district is therefore to make a critical survey to ascertain what mosquitoes are carrying the parasite and what their breeding habits are ; after which, if feasible, steps specifically directed against the carrier species may be undertaken. The marking down of the carriers and their habits is no easy task, and could not well be done efficiently in less than a year [19]. If it is not desired to postpone steps for this length of time, by catching and identifying large numbers of mosquitoes, and consulting the literature, valuable information can be obtained as to the best measures to adopt against those known to be carriers.

To illustrate the diversity of breeding habits the following instances may be quoted :—

Anopheles maculipennis, a well-known carrier, breeds chiefly in swamps and marshes, and does not breed in running water, so that it can be attacked by draining the swamps. Conversely, *A. maculatus*, which gave rise to

much trouble in the Federated Malay States [20], breeds in running water. Other things being equal, therefore, draining by open drains (the usual method) would not abolish but rather encourage the breeding of this species. Yet another, *A. stephensi*, is almost exclusively a well-breeder and can only be countered by screening or oiling the responsible wells. It can thus be seen that haphazard measures are almost bound to involve a waste of time and money, and may even render the last state of affairs worse than the first by taking away conditions under which harmless mosquitoes were breeding and replacing them by others suitable to the propagation of carrier species.

The following measures embrace all the different types of anti-larval work, but only those which affect the proven carrier should be adopted in any district.

Drainage is adopted in the case of marshes and swamps and areas where "seepage water" appears, the latter usually occurring where a permeable layer of soil outcrops on a hillside. It is much better that the work of drainage, if it is of any extent, should be carried out by competent engineers, to whom it should be explained that dryness of the soil is the object in view. Experience has shown that for marshy tracts of lands open drains, if possible lined with concrete, with sloping sides, and rounded towards the bottom, are most efficient, and are to be preferred to underground drainage by unglazed pipes [21]. A special type of open drain, lined by concrete reinforced with wire netting, was found to be most successful in Panama. Simple ditches or drains cut in the earth, while they may be made to serve, have the grave disadvantage of needing constant attention on account of their getting choked by vegetation or broken down by cattle. Whatever type of drain is used it must tap the whole of the marshy area, and in the case of concrete drains have "weep-holes" at frequent intervals. The system should consist of numerous branches joining up into one main channel in which the water is led away to a convenient watercourse. The result of such a system of drains, well executed, is to lower the level of the subsoil water and convert the swamp into dry land. The gradient of the drains is important—there should be a regular fall sufficient to ensure a steady flow of water.

Seepage-water is most successfully treated by a series of drains across the face of the hillside, connecting with another running to the bottom of the hill and opening into the nearest watercourse. Underground tile drains have been found most suited to this particular purpose.

Streams and ditches are treated by canalization, that is, by constructing central channels of definite gradient and sufficiently large in section to take all the water, so that there is a constant flow and all pools and backwaters are eliminated. The work of canalizing a stream may be very considerable, involving blasting in some cases. It is furthermore a constantly recurring task, as in addition to the depredations of men and animals, showers of rain causing torrents are apt to wash away the work which has been done.

This is not a measure to adopt in the presence of carriers which breed in running water.

Small ponds may be dealt with by draining or filling in, but often this is impracticable, and generally it is so with large ponds and lakes. In these, mosquito breeding occurs round the edges, among rushes and rank grass. The edges should therefore be freed from vegetation by cutting or burning, both to allow the natural enemies of the larvæ to have access to them, and to permit of easy application of larvicide as will be described.

Casual collections of water in connexion with dwellings and gardens need constant attention. It is a safe rule to empty and dry at least once a week all vessels, mali-ponds, etc., containing water, for as the aquatic stage of a mosquito's life occupies longer than this period, no eggs laid can come to maturity; but care must be taken that the larvæ or pupæ poured out are actually destroyed and do not find their way back again. Old jam tins should be flattened out. The possibility of water lodging in a sagging roof gutter must not be forgotten; this applies equally to cavities in trees, hollow bamboos, and other similar potential breeding places. The remedy in each case is obvious.

Unavoidable collections of water for domestic purposes such as wells or storage tanks where there is no piped supply should be protected from ovipositing. They may either be covered in completely by wood or galvanized iron, or may be screened by means of wire gauze (screencloth). The mesh of the latter is of importance. When made of 30 I.S.W.G. wire, a mesh containing fourteen holes to the linear inch will prevent the access of mosquitoes, but where there is the possibility of eggs being washed into the tank, an 18-hole mesh screencloth should be used. The newly emerged imago is soft and might find egress through the coarser mesh, but would be stopped by the finer [22].

It should also be emphasized that piped water supplies will prove a source of trouble unless steps are taken to drain away the waste water. Similarly, engineering operations which involve the damming or diverting of streams may bring about mosquito breeding. An intelligent anticipation of such contingencies will often make it possible to avoid the dangers involved.

Lastly, in combination with many of these measures it will be found advisable to use larvicides. Oil is most commonly used because of its safety. Crude oil has been found most satisfactory, though it has the disadvantage of being difficult to spread into a good film. Kerosene spreads better, but the film is more easily broken by wind, and it is expensive. Oil acts better when sprayed on the surface of water. This, however, may involve considerable labour, and has led in some cases to the employment of automatic oiling devices. Of these the most commonly used is the "dripper," which allows so many drops per minute to fall on the water which is being treated. Unfortunately owing to the viscosity of the oil such drippers are very liable to go out of order, and cannot be left for long

without attention. They are suitable for ditches and slow flowing streams where a constant application of oil is required. Where continuous oiling is not applicable, as along the edges of lakes, or elsewhere where water cannot be removed, periodic applications must be made at intervals to be decided by a study of the mosquitoes which are being attacked, the interval being less than the time which it takes an egg to develop to a mature insect. Once a week is a rule that will cover most cases. Prior to oiling, all obstructions likely to break or interfere with the film should be cleared away. Such oiling was extensively used in Panama for lakes and other collections of water which could not be drained, as well as for ditches and small streams.

Poisons which mix with the water and destroy the larvæ in this way by direct action must be non-toxic to domestic animals and man. This is a difficult condition to fulfil, and one which militates against the use of such preparations, for short of toxicity larvicides render water unpalatable, and in densely populated countries such as India there are few sources of water which are not used for drinking purposes. This is in fact a condition which constitutes a never ending obstruction to all anti-larval measures. The nullah which is responsible for mosquito breeding is generally the washing ghat of the bazaar, and canalization is an almost impossible ideal. It has inevitably the opposition of the native, who cannot be expected to understand the necessity for it, and if he does probably looks on it as a greater evil than the mosquito.

In Macedonia, cresol was used as a larvicide with some success [23]. It was found that a concentration of 1 in 100,000 prevented mosquito breeding, yet was harmless to animals and vegetation. In Panama preference was ultimately given to a soap composed of resin, soda, and carbolic acid.

The use of the natural enemies of mosquitoes has at present only a very limited application. Larva-eating fish may be introduced into ornamental fountains and ponds, but it is exceptional for the larvæ not to be able to find some hiding place where they can remain unmolested. More drastic measures are generally necessary.

In brief review of all these measures, it will be seen that the crux of the whole matter is the practicability of any scheme of larva destruction when considered in terms of pounds, shillings and pence. There is little doubt, that given the necessary capital, and access to the necessary labour, one could render any area mosquito free, but before embarking on such a scheme it is well to consider the "pros and cons." In this the experiences of the past, both successes and failures, are the best guides, but the difficulty often arises that other methods besides larva destruction have been employed and it is not always easy to determine how far results are due to larva destruction and how far to other things.

It is readily obvious that Ismailia is a very nearly ideal spot for such measures to succeed. It is but a small and circumscribed oasis in an arid

desert. The breeding places can all be accurately assessed and periodically treated. Supervision is easy. Immigrant mosquitoes present no real menace. The indigenous mosquitoes which carry the disease are of the domestic type, specialized in their habits and breeding places and hence easily routed. Owing to the relative density of the population, measures can be conducted at a low expenditure per head. The population is largely under the control of the Suez Canal Company and hence amenable to discipline. Everything augurs well, and it is little wonder that the steps taken have given good results.

Similar good results were obtained at Port Said, where conditions were comparable except for a greater degree of official obstruction. Of Cairo the same cannot be said, because it was impossible to make the campaign universal. Nevertheless a reduction was effected in certain areas.

In the city of Athens it was found that the bed of the river Ilissos was responsible for large numbers of mosquitoes. This was canalized, and a remarkable fall in the number of cases of malaria ensued. Here no other measures were employed [24].

In parts of Mauritius, and in certain districts in India, the amount of malaria has become negligible through the application of anti-larval measures.

In the famous Panama Canal campaign, it is difficult to estimate what proportion of the excellent results obtained was contributed by the different measures adopted, for every known method was put into operation (at an expense, it may be noted, of 350,000 dollars per annum, the total area involved being about fifty square miles) [46]. Thus, screening of quarters was compulsory, and "quinine dispensers" spent their whole time going from gang to gang giving the negroes quinine. Le Prince fully details the measures adopted, but unfortunately gives no statistics showing that a reduction in mosquitoes actually did occur. Coupling with this the statements that from 1911 onwards (the campaign having started in 1904) mosquito traps were used and "it was not uncommon to catch several hundred per night in one trap" [26], that "in the screened barracks of Miraflores in April, 1912 (the dry season), the average daily catch was sixty, but that as many as 500 had been caught in one barracks at other seasons" [27], that at Gatun, between January and March, 1913, more mosquitoes were found than had been found in any settlement since work began on the canal [28], a considerable doubt arises as to whether the actual larva destruction played the leading part that is often attributed to it.

In Italy, where malaria has been very prevalent and much study in prophylaxis has been undertaken, it is recognized that, in rural districts at least, complete destruction of mosquitoes is a very problematical accomplishment, and more is attempted by means other than drainage.

In the German colonies in pre-war days Koch and others came to the conclusion that prophylaxis by mosquito reduction was impracticable.

During the war measures on a large scale were tried on several fronts,

and their results are very instructive. The case of Macedonia has already been cited. Here there existed a state of affairs which presented an almost complete contrast to that in Ismailia. Units of the army were scattered over a tract of country containing lakes and marshes many square miles in area. The uplands and hills were furrowed by a maze of small streams in which *Anopheles superpictus*, an active carrier of malaria, bred freely. The whole country was a potential breeding ground, and in actual fact proved to be mosquito infested. In the base areas, where the troops were more or less densely packed, it was possible to treat all the breeding places thoroughly and a reduction of mosquitoes was brought about, but up country, where it was beyond the power of units to attend to breeding places outside a half-mile radius from their camps (and in many cases not so far as this) large tracts of country were of necessity left untouched or placed under the care of "anti-malarial squads" who inevitably had more work than they were capable of executing properly. It is little cause for wonder that the reduction of mosquitoes was barely appreciable when the immensity of the task is taken into consideration; for the work of drainage and canalization is a veritable task of Sisyphus. Any reduction which did occur was to little purpose, for as Wenyon points out [29], "when the number of mosquitoes attacking an individual amounts to hundreds if not thousands, the reduction of these by a small proportion will hardly lessen the man's chance of infection." Always there was the immigration of mosquitoes from areas where for the moment breeding was unchecked, and more especially was this the case near the front line where the proximity of the enemy led to large areas going untouched. Finally the expense, especially in man power, of these attempts at mosquito destruction was very great. Each unit had to contribute labour, which means that soldiers were diverted from their proper duties, and in addition large gangs of natives were employed, all, as can be seen now, with little effect.

In Palestine, during the stationary phases of the campaign, a good measure of control was obtained, the circumstances being comparatively favourable, but as soon as the final advance took place the control broke down and the disease became rampant.

CONCLUSIONS REGARDING ANTI-LARVAL METHODS.

There is only one conclusion to be drawn from all these experiences, namely, that every case must be judged on its own merits. In small and urban areas such as Ismailia, where success can be more or less assured, larva destruction is *par excellence* the method of malaria prophylaxis. Conversely in countries such as Macedonia—sparsely populated, marshy, ubiquitously prolific of mosquitoes—it is unlikely that much good will be done other than by drastic and impossibly expensive drainage. In any case before undertaking such measures, the situation should be assessed as accurately as possible, and an estimate made of the degree of the reduction of the carriers which might be expected, in the light of past experience, to

result from the measures proposed, and unless it is anticipated that the reduction will be very nearly absolute, it would be well to consider whether "the game is worth the candle," and the energy and money had not better be expended in other directions.

As far as active service is concerned larva destruction can have but a limited application. Its rôle is that of a permanent rather than of a temporary measure. In a country which can justly be called malarious its efficient execution involves an expenditure of capital which could rarely be justified except on the ground of results to be reaped for years to come; to employ it in a half-hearted fashion is to court disaster. It is apt to be slow in producing results. It involves much labour, and at best is bound to be limited, often at the most important points, by enemy action. For all these reasons it cannot be considered to rank high among war-time measures. In base areas it may be possible to inaugurate suitable schemes, but elsewhere, beyond dealing with flagrant breeding places, actually in or in immediate proximity to camps for the sake of sanitary discipline and a partial increase of comfort, it is doubtful if such measures will ever be of real practical value.

PROTECTION FROM THE BITE OF THE MOSQUITO.

In the protection of the individual from the bite of the mosquito lies the third main line of defence. This method, when effective, acts in two ways; it prevents mosquitoes from becoming infected by sucking blood containing gametocytes, and it prevents those already infected from passing on the parasite to man. Methods of destroying adult mosquitoes (as distinguished from anti-larval measures) are included in this section.

First of all a measure of protection can be afforded to any camp or village in which mosquitoes are not actually breeding; by cutting down and clearing surrounding brushwood and jungle, and by doing away with anything in the form of undergrowth or other shelter which might afford protection to mosquitoes. The insects take refuge in the shady depths of such vegetation during the day, and do not tend to frequent places which fail to afford such shelter. During the construction of the Panama Canal it was a standing order that brushwood be cleared for 200 yards round every village and camp, and Gorgas considered this a measure as important as drainage [30]. The observations made by Le Prince [31] on the "fighting" of mosquitoes run somewhat contrary to this idea. Le Prince at Gatun, in 1913, observed and demonstrated to others that at dusk mosquitoes, which were breeding freely in a marsh over half a mile from Gatun, flew in clouds to the village, passed the night there, and flew back at dawn to the marsh. A migration of sorts had been previously recorded, and is noted by Ross [32], but this author, although aware of its possibility, appears never to have encountered personally such a phenomenon, and it is probable that it arises only in certain circumstances, and does not really invalidate the principle of clearing undergrowth, the more so as in

practice measures of this kind have undoubtedly proved effective in reducing the numbers of mosquitoes in a locality.

Either by itself, or in conjunction with scrub clearing, some method of destroying adult mosquitoes which remain in or about dwelling houses and tents or dug-outs during the day-time is of great value. This is especially important where there is any possibility of the insects having obtained access to an infected person. As a rule, a mosquito which has just had a heavy meal of blood is lethargic and does not fly far, and thus those found about dwellings in the day-time are the ones whose destruction is most important.

Mosquito traps may be used for this purpose. A good mosquito trap is so constructed and placed that it offers seductive shelter for the day-hours to insects that have visited a dwelling during the night. There are many types of trap. A fairly deep box lined with dark blanket and with a lid or door so that it can be closed readily will be found quite effective. As daylight advances the mosquitoes fly inside to the dark and cool corners and settle there to pass the day. When morning has advanced so that there are no more in flight, the door is closed, and a little chloroform or ether introduced to kill those caught. Another form of trap is a rectangular framework covered by mosquito netting, and having a door at one end [33]. This is placed in a convenient spot with the door slightly ajar, and is rendered dark by throwing over it a tarpaulin or some similar covering. To add to the catch other possible resting places should be kept disturbed. In due course the door of the trap is shut, the tarpaulin removed, and the insects may either be killed by placing the trap in strong sunlight for a few hours or may be kept to be destroyed at will. In such a trap suitably placed in a garden in Colombo, James caught an average of 280 mosquitoes per day over a period of two months. Such catches must have a considerable effect in reducing the numbers of infected mosquitoes.

Another method which became very popular in the latter part of the Panama campaign was "hand-catching," a man being trained to go round barracks each morning and to catch all the mosquitoes therein either with a test-tube or with a hand-net, or alternatively to kill them with a "swatter." This leaves less to chance than the trap, and requires a minimum of apparatus, but is difficult to apply to barracks or bungalows with lofty roofs where the mosquitoes fly out of reach. This difficulty has, however, been overcome with some success by whitewashing all walls and roofs and painting a black band round the wall at an accessible height [34.] The mosquitoes select the black band as a resting place in preference to the white, and can be destroyed there. Striking instances of the reduction of malaria attributable to hand-catching of mosquitoes are quoted by Le Prince [35]. The method is a very effective one not because it does much towards reducing the actual number of mosquitoes, but because it deals largely with those particular insects which in due course may become infected. It is furthermore simple and capable both of application under all circumstances and of easy supervision.

Occasionally a bungalow or a barrack room becomes so infested by mosquitoes that special steps in the shape of some form of fumigation have to be adopted to get rid of them. The burning of sulphur in quantities of two pounds per 1,000 cubic feet is effective, care of course being taken to seal the apartment which is being treated. The fumes are allowed to act for two hours. Unfortunately sulphur has a deleterious effect on metals and fine fabrics. Pyrethrum powder is substituted on this account. It is used in the same quantities, but has to act for four hours and may only stun mosquitoes, so that after using it they must be swept up and burned.

Whilst it is an undoubted fact that anophelines will bite during the day in shady places, nevertheless from dusk to dawn is the usual time of attack, and it is during this period that protection is required.

Ideal protection is afforded by screened bungalows or huts. These may be constructed in a variety of ways, but must all have doors, windows, and ventilators protected by screencloth of a sufficiently small mesh (fourteen strands to the linear inch of 30 I.S.W.G. wire) to prevent the ingress of mosquitoes. In bungalows it is usual to screen off verandas, as these are used both as dining and as bedrooms. Doors where possible should face the prevailing wind as mosquitoes tend to collect to leeward and are more liable to make their way through doors on that side. Some automatic closing device should be incorporated in all doors. Unfortunately screening of this type has little scope under active service conditions, as it is but rarely that it is practicable.

From dusk till bed-time where there is no effective screening, no parts of the body should be left unnecessarily exposed. Men should have "turn-down" shorts to cover their knees. Officers and nursing sisters should have their ankles thoroughly protected by thick hose or preferably by "mosquito boots." Hands and faces should be carefully watched, in which connexion a little mutual co-operation is of great value. In the case of sentries and picquets or nursing sisters on night duty, gloves and face-nets may be used, the "Simpsonette" being a useful model of the latter. The drawback to all such devices is that they are apt to be insufferably hot and are often surreptitiously discarded for this reason, also to a certain extent because they interfere with the performance of duty. Though their use should be encouraged, too much reliance cannot be placed on the protection they will afford.

An alternative is the use of repellants—chemical substances distasteful to mosquitoes which are applied to exposed parts in the hope that they prevent the insects from biting. Essential oils of various kinds are used for this purpose, the best known being citronella oil or oil of lemon grass. In India a mixture of oils known as "bamber oil" is now used as a routine measure. It contains citronella oil, coconut oil, kerosene, and carbolic acid [36]. The objection to all repellants is that they evaporate off or are absorbed and so lose their effect. This makes them of dubious

value for protection during sleep, but in the case of people doing night duty repeated applications can be made and a very useful purpose served.

Electric fans where they are available are of considerable service in keeping mosquitoes away from their victims, but their use is very limited. Hand fans as a measure for keeping off mosquitoes are by no means to be despised. A palm leaf fan and a small hand net were favourite weapons by the use of which Ross added to the comfort of his evenings.

The last and by far the most important of all measures of protection is the bed net or mosquito curtain. Although a person is liable to be bitten during the evening hours, the fact that he is alert and moving about makes him less accessible to the insect, and it is a matter of common experience that the majority of bites are acquired during the hours of sleep. All such bites can be avoided by the intelligent use of a suitable bed-net, and the chances of malaria infection can thus be enormously reduced.

What are the essential features of a good bed-net? As regards fabrics it must combine several characters. It must have a mesh sufficiently small to prevent the passage of the mosquito: it must let through as much air as possible, and it must be sufficiently strong to stand wear and tear. The factors concerned in this are therefore the thickness of the cotton used and the closeness of the mesh. The correct trade method of estimating the mesh of netting is rather peculiar, and consists in counting the number of holes along a line of the warp and a line of the bobbin falling within a superimposed square inch, and adding these two counts together. If this should be, say twenty-five, the netting is said to contain twenty-five holes to the square inch, though of course the actual number of holes is much greater than this [37]. MacArthur has shown that netting woven of 30/S or 40/60 cotton with twenty-five or twenty-six holes to the square inch (trade counting method) cannot be passed by *Stegomyia fasciata*. That made of 30/S cotton owing to its greater strength is probably the better of the two for active service use.

For ordinary beds a rectangular shape of net is better than a bell shape, as the user's arms are less liable to come in contact with the side. The net should be both long and broad to obviate as far as possible the sleeper throwing bare arms and legs against it; in any case the net should have a strip of calico sewn round it above the level of the mattress to prevent exposed parts from being bitten through the meshes. The net should be hung so as to allow as much space as possible above the sleeper for the sake of coolness, yet should be long enough to allow of liberal "tucking in" under the mattress. It should be tightly stretched to allow air to blow through. Where such precautions are observed there is little fear of the occupant being bitten whilst asleep.

The use of the mosquito curtain is applicable either in peace time or on active service. For the latter a special form of net needs to be provided and arrangements for its transport made, but so great is its importance in reducing sick rates that these are minor difficulties which must be overcome

by one means or another, In Salonica a satisfactory net was ultimately evolved. This was bivouac-shaped and was made to hang under bivouac waterproof sheets. Each net was devised to take two men, who entered at one end. This end was weighted by filling pouches round the bottom of it with sand. It ran on rings along the front guy rope, and so automatically fell to the ground in good position when the occupants entered and released it. To perfect such a bivouac it is necessary to dig a central trench eighteen inches deep, and on either side two bed platforms six inches below ground level.

It is important that nets should always be available, that they should be kept in good repair, and that a sufficient number of spare nets should be easily accessible to afford immediate replacement of any net seriously damaged. Even in the absence of bivouacs it requires very little ingenuity to hang a net by some improvised means, and nothing should ever be allowed to serve as an excuse for not using the net. The interest of officers in this matter should be directly stimulated. Frequent inspections should be made, and strict supervision of the use of the nets exercised.

Provision of one kind or another should always be made for people travelling by train at night, which in India is a very fruitful source of malaria. Nets are rarely practicable, but repellants can always be used and should be made a routine measure in these circumstances.

PROPHYLACTIC QUININE.

In the use of prophylactic quinine we have the fourth line of resistance, one which aims, by the exhibition of small doses of quinine, at destroying malaria parasites as soon as, or very shortly after, they have been introduced by the mosquito. In the broadest sense of the term it also includes quinine given with a view to preventing relapses in a malarial patient, but as this has already been discussed when considering the elimination of the reservoir of infection, no more need be said than that there is no question as to the value of quinine given for this purpose. It to a large extent prevents relapses, and where it does not completely do this it at least greatly reduces their number, and also the number of gametocytes in the peripheral circulation, a point of no small importance in relation to the infection of mosquitoes.

The methods of administering prophylactic quinine are numerous, but they can roughly be divided into those in which the drug is given regularly each day, and those in which larger doses are given at intervals of a few days. Perhaps the most approved method is to give five grains each evening an hour before dusk. James recommends a further five grains about midnight to be taken where a mosquito curtain is not being used, the reason for the second dose being that, as quinine is fairly rapidly eliminated from the circulation, this method is more likely to ensure the presence of a proportion of the drug in the blood during the night. Koch's method [38] was to give fifteen grains on the tenth and eleventh days. The argument

against this second method is that should an individual be bitten as soon as the effect of the dose has worn off, the parasite has eight or nine days in which to multiply before it is subjected to the action of a further dose, and is consequently not so amenable to the drug. In a very malarious country this method is therefore unsuitable, and the consensus of opinion is that in general the daily dose is best. In the quantities given its unpleasant effects are practically nil, and when taken regularly each day it is less apt to be forgotten than when it falls due at intervals.

Much controversy has raged round the question as to whether prophylactic quinine, however taken, has any value in preventing malaria. It was certainly used on a large scale in several theatres during the late war without any very apparent good results ensuing. Thus Wenyon [39] in reference to Salonica states that in his opinion the expenditure of money and labour involved in the administration of prophylactic quinine was not worth while. The French in Macedonia had equally disappointing results, as according to Paiseau [40], although the mortality was probably reduced by this means, there was little evidence that the incidence was similarly affected. Treadgold [41], in an investigation of a rather small number of cases, reaches the conclusion that in Macedonia quinine alone is quite unable to prevent malaria. Watson [42] writing with reference to the Federated Malay States, concludes that the use of quinine can never make any material reduction in the liability to infection in an intensely malarious locality.

On the other hand, however, there are a host of opinions in favour of the use of prophylactic quinine. Treadgold [41] has analysed 201 original papers, and finds that 134 of the writers favour this method, 27 favour it with reservations, and 40 are against it. Those who advocate its use include such experienced observers as Ross, James, Celli, Koch and the brothers Sergent, to quote but a few.

How can such divergent opinions, based on results, be reconciled? Wenyon suggests that the explanation lies in the existence of certain strains of plasmodia which are quinine resistant, and are not affected therefore by the prophylactic dosage. Among trypanosomes the existence of analogous drug-resistant forms has been definitely proved. In a country where mosquitoes are relatively few such resistant strains of parasites run a much smaller chance of being transmitted than they do in a country where mosquitoes are very numerous, where an individual may be bitten several times per night by infected mosquitoes. Such a person has a much greater chance of being infected with a resistant strain, and through the selective action of the quinine this resistant strain is prone to increase. This author admits that this is a purely speculative theory, yet it fits in well with facts. Gosse [43] in describing a small but well controlled investigation in Mesopotamia, where the results were good, suggests that good results and bad results depend on the intensity of the infection, quinine in the doses usually given being of less value where a large number

of infected bites per day are received. Ross implies a similar explanation in a footnote on Watson's contribution to his book [44].

Another possible explanation of diverse results lies in variations in the thoroughness with which the quinine administration is carried out. In certain jail experiments in India [45] very good results were obtained where the administration was rigidly controlled. On active service, given the best will in the world, absolute regularity for everyone is a very difficult ideal to attain, and the failures may in part at least be accounted for through lack of continuity in administration. Whatever the cause it remains a fact that the results of this method under active service conditions in intensely malarious countries have not been good.

To summarize, it would seem that where mosquitoes are not unduly numerous, and where administration can be rigidly controlled, prophylactic quinine is of value in preventing malaria. It appears to reduce the severity of such cases as do occur. Conversely, in an intensely malarious country where mosquitoes are very numerous, and especially under active service conditions, its value is much more doubtful.

ADMINISTRATIVE AND OTHER DETAILS WITH REFERENCE TO ACTIVE SERVICE.

These, then, are the four methods by which malaria is attacked. All will be seen to have their limitations, some having a much more specialized application than others. It must again be reiterated, that although theoretically a combination of all methods should give the best results, in actual practice it has been proved best to select, concentrate on, and bring as near perfection as possible, *one* method. Especially is this the case on active service where a cut-and-dry, universally and rigidly applied scheme is sure to give better results than a diversity of half-hearted measures.

It remains now to crystallize out from all these principles a scheme which will embody the most suitable measures for active service. In doing so the governing factor to be borne in mind is that the function of an army is to conquer the enemy, and that the preservation of the health of the army is a means to an end and not an end in itself. This must therefore be accomplished by the most economical means compatible with good results, and with as little derangement of the normal duties of the soldier as possible. By this it is not meant that sanitation should be looked on as a secondary matter, but that sanitarian and combatant must adjust their perspective to the facts of the case, and by mutual co-operation reach the highest mark of efficiency.

MATTERS TO BE CONSIDERED PRIOR TO THE INCEPTION OF THE CAMPAIGN.

Questions of the time of year in which a campaign (if a short one) is to be conducted, of the employment as far as possible of immune native troops, of the employment of only seasoned Europeans, and similar matters already detailed, will have to be decided in the consideration of the general

strategy of a campaign. They are of vital importance, for a malarious country should never be invaded without counting the cost. The best medical advice on the subject should be solicited, and full weight given to any suggestions made. Prevention is always better than cure, and to avoid the disease in locality or in season is the surest form of prevention.

SPECIAL PROVISIONS.

In the event of circumstances of extreme urgency making it necessary to inhabit a malarious country during the season of prevalence, it may be taken for granted that in the absence of adequate precautions an epidemic will be the inevitable result. As far as possible everything should be prepared in advance to combat this contingency.

Arrangements should be made for an adequate supply of mosquito nets. As the climate is such in most malarial countries that bivouacs will be the commonly used form of shelter, the bivouac mosquito net of the type described is the most suitable. This is issued at the rate of one per two men. A large reserve should be held available for the replacement of damaged nets. The men should be instructed in the use of these nets, and should have them issued and ready for use the first night they sleep within range of the mosquito. As the soldier is sufficiently loaded, arrangements must be made to have the nets carried by first line transport. A suitable repellent should be supplied for use under special directions. A sufficiency of quinine for all emergencies should be prepared.

In any but the shortest of campaigns screened hutments should be provided as dining halls and recreation rooms for base units, and where practicable for permanent lines of communication posts. These are not luxuries but necessities, and will more than pay for themselves. If base units can be housed in screened huts so much the better. If possible huts should be erected by the advance party.

All hospitals for the treatment of malaria should be of screened huts. It has been suggested that for small forces, where the number of sick and wounded is not high, two hospital ships should be used, one to be available for the reception of sick coming from the front, while the other conveys its complement of sick and wounded to the nearest healthy port.

A medical officer (or a team of officers in the case of a large campaign) with a special knowledge of malaria and entomology, should be selected and detailed to investigate the state of affairs and advise the Senior Medical Officer along the lines which will be indicated later. This appointment should be made as early as possible to allow schemes to be drawn out prior to the landing of the main body of troops. This officer should, of course, form part of the advance party if such can be sent.

Finally, some provision must be made for the early microscopic diagnosis of those cases which will inevitably occur. The clinical diagnosis of early malaria is by no means simple, especially where other fevers are occurring, and the only absolute diagnosis on the strength of which a patient can

be embarked on a prolonged course of quinine, is the discovery of the parasite in the blood. In Salonica mobile laboratories were available for this purpose. In Egypt, malaria diagnosis units were instituted, consisting of locally trained officers and orderlies equipped with the bare essentials for malaria diagnosis—slides, stains, a microscope, a tent, and a table [8]. Such a unit is a very economical and convenient one for malarial countries, and something along its lines should be provided where the more expensive mobile laboratory is not available. The number required would turn not so much on the number of troops as on the length of front occupied.

DUTIES OF THE ANTI-MALARIA OFFICER.

The first duty of this officer, on being informed of the country where the operations were to take place, would be to refer to the literature on the subject dealing with that locality for detailed information, first as to the type, severity, etc., of the malaria which occurred in that district, and secondly as to the local types of mosquitoes and especially those which were normally carriers. A key to the mosquitoes as far as known should be obtained from or through the Professor of Tropical Medicine at the Royal Army Medical College. Equipped with these details, and the apparatus necessary for entomological and malarial investigations, he should repair as soon as possible to the scene of operations.

He will, in collaboration with the sanitary staff officer, advise the general staff on the selection of sites for base camps, avoiding all localities likely to be unduly infested by mosquitoes, and those near native dwellings. Where for strategical reasons native villages cannot be avoided (if there is reason to suspect from the spleen index of the children that malaria occurs among them) the inhabitants should be cleared off to a safe distance and the village burnt. If the object of the expedition affords any choice of routes these should be investigated, and that which best conforms with the tenets laid down should be selected. Similar advice on the location of permanent lines of communication posts will be given.

Where the occupation of the base or lines of communication is expected to last some considerable time, the anti-malaria officer must consider the possibility of exterminating the mosquitoes by larva destruction. His first step in this is to ascertain what mosquitoes are carrying the disease and study their habits. If a specialized breeder, such as say *A. stephensi*, is the cause of the trouble, the matter is simple and may be easily remedied, but if it is a marsh breeder such as *A. maculipennis*, or a stream breeder like *A. maculatus*, it may be almost an impossibility to stamp it out. In any case definite conclusions must first be formulated, the cost of a scheme certain (as far as can humanly be gauged) to be successful, estimated, and the advisability of the whole matter conscientiously reviewed. As a general rule, especially in small campaigns, it will rarely be possible to devise a scheme of larva destruction that is not outrageously expensive; in which

case the only conclusion to be drawn is that a similar result must be produced by some less costly method.

If, however, a scheme of larva destruction be decided on, the anti-malaria officer will advise the sanitary officer concerned of the steps to be taken. The actual work, whether draining or oiling or filling up pools or canalization of streams as may be decided, is best carried out by native labour supervised by N.C.O.'s of the sanitary sections. If the work is extensive the help of the Royal Engineers may need to be called on.

In the case of front line units it would only be in the most exceptional circumstances that the conditions given could be fulfilled and larva destruction on a large scale become justifiable.

Despite this it is always advisable to enjoin the destruction of breeding places which are actually in lines, or in their immediate vicinity ; partly as a measure of policy and sanitary discipline, and partly because it will help to reduce the excessive numbers of insects liable to arise from such proximity, though it is unlikely to affect the malaria incidence.

PROPHYLACTIC QUININE.

Prophylactic quinine has so signally failed to prove its value during the late war that it must be ruled out of court as a routine measure for armies on active service. If, however, an unduly high malaria mortality were occurring, it might be given with a view to reducing this. Similarly it might be used for posts under circumstances where absolute control of administration could be ensured. The whole question could very profitably be investigated by well-controlled experiments. If given, the quinine should be in solution, and should be administered in doses of 5 to 10 grains about 18.00 hours each day. The strictest supervision must be exercised by the medical officer in charge to see that the dose is regularly taken.

DUTIES OF THE MEDICAL OFFICER.

The medical officer will act as the adviser of the officer commanding the unit to which he is attached, and will keep in touch with the various anti-malaria measures that are being taken. He will keep accurate statistics of the cases of malaria occurring in the unit under his charge, and will try to trace the cause of any undue prevalence. He will satisfy himself that all recommendations made are being carried out, and will make representations where he has reason to believe to the contrary. He will in the absence of special recommendations from the anti-malaria officer advise on the site of camps, and will also indicate to the sanitary squad steps to be taken for the prevention of mosquito-breeding in or in immediate proximity to lines, and also as regards scrub cutting. He will instruct all ranks in the theory and the importance of malaria prevention, and will train men in the hand-catching of mosquitoes. He must be personally responsible for the administration of quinine given in the after-treatment of malaria. For this purpose a " malaria card " giving all the particulars of the attack, must be kept for each case, and must accompany

the man wherever he goes. On this should be entered from day to day the treatment, and by the use of this and a "quinine roster," there should be no occasion for error or lack of continuity in dosage. Here as elsewhere results will be obtained by meticulous attention to detail.

MEASURES FOR ROUTINE APPLICATION.

Having dealt with matters which may or may not apply according to circumstances, we come to the method which is the bedrock of all active service measures of protection, and propose to formulate from it a set of rules for application under all circumstances. This is the method of protecting the individual from the bite of the mosquito. For many reasons this is the method on which to concentrate. It applies equally under all circumstances, and is as useful in the front line as at the base. It is not unduly expensive and does not involve much labour, for being a method in which a little work has to be done by everyone, a large total of work is done without very much appreciable effort. It serves to keep apart both the healthy person and the infected mosquito, and the uninfected mosquito and the malarial person. It appeals to the men, for as well as preventing malaria it adds materially to their comfort. Lastly, but by no means least in importance, the responsibility for the execution of the necessary orders in connexion with it can be placed in the hands of unit officers, and any neglect can be made the subject of ordinary disciplinary measures.

The following set of rules is suggested for universal and routine adoption by all whom they may concern.

(1) *Mosquito Nets.*

These should be made of the standard fabric already described (30/S cotton and twenty-five to twenty-six holes (trade counting) to the square inch).

There should be at least one standard pattern bivouac net to every two men.

Where bell-tents are used, one full-sized bell-tent net for each should be supplied, and the number of men per tent should be kept as low as possible.

A daily inspection of nets should be made, and all small holes kept carefully darned.

A margin of ten per cent of nets should be kept in unit stores to replace immediately nets which become seriously damaged.

Nets must be lowered half an hour before dusk, and after lights out an inspection should be made by the orderly officer to see that they are properly in position. Further, surprise inspections should frequently be made, and severe disciplinary action taken against offenders neglecting to use their nets properly.

Rest camps should be of screened huts or bell tents fitted with full-sized nets. The fringe of these must be weighted to keep a good contact with the ground, and there should be an efficient means of closing the door. A search should always be made for mosquitoes inside such a net before turning in for the night.

(2) *Protection between dusk and bedtime.*

Shorts must be of the "turn-down" variety, and must be turned down half an hour before dusk.

Shirt sleeves must be turned down at the same time.

Mutual co-operation must be indulged in to brush off mosquitoes from hands and face. The use of hand fans should be encouraged.

Officers and nursing sisters must protect their ankles by thick hose or mosquito boots.

Full use must be made of screened huts where these are available.

(3) *Picquets, Nursing-sisters, and others on Night Duty.*

Either gauntlets and face-nets (e.g. the Simpsonette) should be worn, or repellants should be applied at frequent intervals.

In the case of picquets and guards the repellant should be issued to the N.C.O. in charge with orders regarding its application at regular intervals. As a rule two-hourly intervals will be sufficient.

(4) *Killing of Adult Mosquitoes.*

Each morning every man must search the dark places in connexion with his bivouac or tent or dugout for resting mosquitoes. These should be killed off with a "swatter."

In addition one man per company should be permanently employed going round these places and accounting for any that have been overlooked. If need be this man can be trained to catch the mosquitoes in a bottle for examination.

(5) *Special Measures which may be recommended by the Medical Officer.*

The cutting of scrub for 200 yards round camps which are to be occupied for any length of time, and the treatment of collections of water in or in immediate proximity to such camps, will be undertaken by the sanitary squad augmented on occasions by fatigue parties as recommended by the medical officer.

In addition to all that has hitherto been suggested there is one further element in the absence of which all these measures will be of little avail. That is the intelligent co-operation of the rank and file. By every means their interest must be stimulated—by lectures, by posters, and by propaganda of every kind. The subject is full of interest, and if lucidly expounded cannot fail to command interest. Special efforts should be made to impress the importance of the matter on junior officers and N.C.O.'s, as they have easy access to the men and can do much to influence them.

In conclusion, stress may once again be laid on the fact that results will be obtained not so much by the application of broad principles, as by scrupulous attention to detail in the methods employed. Malaria is a very vigilant and untiring enemy, and will not fail to use freely any chink which there may be in the armour of protection.

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NOTES ON THE COMPILATION OF THE PROCEEDINGS OF MEDICAL BOARDS.

BY MAJOR-GENERAL C. E. POLLOCK, C.B., C.B.E.

PRACTICALLY every officer of the Royal Army Medical Corps must frequently have been a member of a medical board, yet the perusal of a large number of medical board proceedings suggests that the importance and far-reaching effects of a medical board's decision are not by any means fully grasped by Royal Army Medical Corps officers in general. Army forms B.179A and A45 have recently been revised, and this may be held to justify the publication in our Journal of the following notes which, it is hoped, will enable all officers of the Corps to appreciate more fully the importance of these documents, and particularly in forming their opinion as to the attributability of the disease.

Some useful information about medical boards, sick leave and retirement on account of ill-health is to be found in the Royal Warrant and King's Regulations in addition to that given in the Medical Regulations. The Royal Warrant defines the "Regulated Medical Authority" as a Board of Officers of our Royal Army Medical Corps, and in cases of physical unfitness the whole career of any individual in the Army and the grant of a disability pension, if invalided out of the Army may, to a great extent depend on its finding. A medical board combines the duties of judge and jury as well as of counsel for both sides, and its decision should therefore only be formulated after weighing carefully all the evidence bearing on the case.

The general purpose of assembling a medical board is to obtain a considered opinion on the state of health of an individual, and on the causes which led to that state. In the case of a *soldier*, a medical board is practically always an invaliding board, as a soldier is only on rare occasions brought before a medical board for any purpose other than with a view to effecting his discharge from the Army on account of physical unfitness.

An officer, on the other hand may, if recommended by a medical board, and if otherwise eligible in accordance with regulations, be granted a period of sick leave in order to enable him to recover his health.

Members of medical boards may be reminded that when they have done their duty and signed the proceedings these are not finished and done with; on the contrary their active life, like that of a new-born babe, is only just beginning. The next stage in their career is a scrutiny by the Deputy Director of Medical Services who, if he approves, passes them in the case of officers to the War Office, and in the case of soldiers to the Commissioners of the Royal Hospital, Chelsea, through the appropriate Record Office. On arrival at Chelsea, the documents are examined with

a view to determining whether the soldier is entitled to any disability award.

ATTRIBUTABILITY TO MILITARY SERVICE.

The award of a disability pension depends on whether the disability was attributable to military service, and it is in answering this question that many boards fail to realize the necessity for a minute study of paragraph 220, Regulations for the Medical Services of the Army.

If an individual is found by a medical board to be unfit for general duty, the board must also record their opinion as to whether the disability is due to military service or otherwise. Paragraph 220, Regulations for Medical Service, lays down clearly the rules which should guide a board in answering this question.

Among soldiers and the civil population the idea is prevalent that the Army authorities are responsible for the after-care and livelihood of anyone who has been invalided out of the Army on account of any disability which may have originated during his service in the Army. This idea is based on the assumption that because the man was accepted for the Army he must have been perfectly sound in health on enlistment, and therefore any disability which may occur thereafter must be due to his service in the Army. This view is quite wrong. The Army authorities can only accept responsibility for disabilities which are the result of military service. Diseases to which the civilian population is equally liable cannot, as a general rule, be ascribed to military service. The soldier is better housed and fed than his fellow civilian, and is therefore less liable to contract the common diseases of civil life. If he does so, and is invalided out of the Army in consequence, it is clearly not the fault of the Army authorities and the individual has no claim to compensation. It is only in cases in which the disability is clearly due to some condition special to military life as opposed to civilian life that a claim for compensation can be considered. As an instance of such take pneumonia, a common disease of civil life. This can only be considered as "attributable" if it is actually caused by the conditions of the soldier's military service, which means that the individual was subjected to some exposure to which he would not have been liable in civil life, e.g., a tour of sentry duty in an exposed spot during bitter winter weather, or a drenching in winter and the impossibility of being able to change into dry clothing; such or similar conditions may fairly be considered as constituting attributability. Tubercle of lung is another disease more common in civil life than the Army. If this is to be classed as attributable, the history of the case must show that the disease was lit up by some condition special to military service, and to which he would not have been exposed in civil life.

If the board is in doubt as to the exciting cause of this or any other disease it should defer its verdict and apply to the person's Commanding Officer for further information to corroborate or refute the individual's statements. The board may in some cases, if supported by the medical

history sheet, take the view that the debilitating effect of repeated attacks of malaria or of prolonged residence in the tropics, or of some similar condition peculiar to military service, may have undermined the man's health, and so have rendered him more liable to develop some disease common in civil life, which probably would not have occurred had he been a civilian residing in the United Kingdom. If this is its considered opinion, then it may fairly return the disability as attributable, but it must state clearly the grounds for its decision.

All invaliding documents are closely scrutinized before an award is made, and if the board merely say in general terms "due to military service" in any case which is not obviously so, the answer is not only of no value whatever to the individual concerned, but it also means much labour and loss of time when the document is being scrutinized, while the finding will almost certainly be reversed.

In one case a board returned a disease as attributable to military service in Palestine. Inquiry showed that the particular disease was almost unknown there. Another board returned tubercle of lung as attributable to ordinary military service in Egypt, a country which enjoys a high reputation as a sanatorium for cases of phthisis. Opinions such as these do not enhance the prestige of the Corps when the proceedings are examined at the War Office where, as a result of long experience of assessing medical board verdicts, some of the permanent staff (other than members of the medical directorate) have acquired a fair working knowledge of the causes and origin of disabilities in the Army.

AGGRAVATION OF NON-ATTRIBUTABLE DISABILITIES BY MILITARY SERVICE.

Mere aggravation by military service of a disability which was not originally caused by such service does not justify a claim for pension. In certain cases, however, the aggravation may be of such a degree as to permit of the disability being regarded as "directly attributable" to military service. Thus a disability may have existed in a mild form before the person joined the Army, but as a result of military service it may have become aggravated to such an extent as to produce a disabled condition, e.g., varicose veins. In such cases the board when forming their opinion as to whether the disease has been aggravated by military service to such an extent that it should be dealt with as though it were attributable, should be guided by the following rules:—

(1) The original disease or injury must have either arisen in the Army or if existing before entry into the Army must be of such a nature as might easily have escaped observation on entry even by a careful observer. This means that if through an oversight a man is enlisted suffering from some well developed disability, the board cannot describe his condition on account of that disability as aggravated by military service.

(2) The condition from which the man is suffering must be definitely due to the conditions of his service, and not such as might arise from the original disease or injury by the mere passage of time.

DEGREE OF DISABILITY.

The correct estimation of this is of the highest importance to a soldier and to an officer if they are being discharged from the Army on account of physical unfitness, as the rate of a disability pension, if awarded, is calculated on the answer given by the board.

When assessing the degree of disability the board may very naturally feel inclined to consider the disability from the point of view of how it will affect the man's earning powers in civil life. If this aspect were permitted curious results might follow. Thus in the case of a street merchant the board might consider that the loss of a limb is a valuable asset and that the man's earning powers had actually been increased by the disability.

This view is not, however, the right one and boards will be guided by the following principle when assessing the degree of disability. "The basis of assessment is to be the degree of disablement estimated to be suffered by the individual as determined by comparison with the condition of a normal healthy man of the same age, without reference to the earning capacity of the individual in his own or any other specific profession, trade or occupation, and without regard to any particular conditions or circumstances."

Bearing the above rule in mind the board should have no great difficulty in assessing the degree of disability.

DURATION OF DISABILITY.

The board will after considering all the bearings of the case state how long in its opinion the disability is likely to last. If an officer is found "permanently unfit" the board is not allowed to recommend any period of sick leave; it should, therefore, be careful not to use the term "permanently unfit" unless it feels certain that the officer will not ultimately be fit to return to duty. An officer found permanently unfit is automatically placed on half pay, unless he elects to retire; he may be retained on the half pay list up to a period of five years, when if still unfit he will be retired.

FITNESS FOR GENERAL DUTY.

Unless specially ordered to do so the board will only express an opinion as to fitness for general duty, remembering that "general duty" means military service in any part of the world.

If the board is satisfied that the individual is insane or is subject to epilepsy then they must find him permanently unfit for general service; a soldier suffering from tubercle of lung is to be discharged as soon as possible. As regards insanity, it must be borne in mind that "certification" only

concerns the restriction of the individual's liberty and has no bearing on the diagnosis of his disease.

In all other cases the board is free to form its decision on the evidence placed before it, together with the result of its examination of the individual. Usually there is not much difficulty in determining fitness for general duty; sometimes, however, much careful thought may be required before answering this question, especially so in those cases in which the disability is known to be likely to recur, or in which it may leave some permanent weakness or increased susceptibility to climatic or other adverse conditions of military service.

Among the principal diseases which are liable to recur are tubercular affections, ulcers of the digestive tract, neurasthenia and internal derangement of the knee-joint, while injuries to the head accompanied by severe cerebral symptoms, as also sunstroke, may render the individual unfit to fill any appointment which demands prolonged brain effort or exposure to the sun in the tropics.

No rules can be laid down as to what the finding of the medical board should be in such cases. Each individual case must be carefully considered and judged on its merits. The board should make itself acquainted with the person's medical history as shown in his documents, then make a physical examination, and lastly, cross examine him to clear up any doubts and to satisfy itself as to his state of health. It is well to bear in mind that an individual may have strong private reasons for desiring to be found fit or the reverse and, that answers to questions by members of the board are liable to be biased, perhaps subconsciously, in the hope of influencing the board's decision. The board must, therefore, exercise caution in taking such answers at their face value.

When forming a decision in such cases the board should be guided by the following principles. If it thinks that the officer might just be considered fit for general duty at the time of the examination, but that he will almost certainly break down again at an early date, then, in fairness to the State and to his brother officers, it should find him unfit. If, on the other hand, it is of opinion that there is reasonably good evidence of a cure having taken place, or at least that the individual will probably be able to continue to serve for many years, then he should be given the benefit of any doubt and be found fit.

In the case of a soldier, if the board does not consider him to be permanently unfit, it may recommend his retention in hospital for further treatment or that he be returned to duty and granted a furlough. If, on the other hand, they consider him to be permanently unfit, he must be recommended for discharge from the service under King's Regulations, paragraph 363 (xvi) either as permanently unfit for any form of military duty, or unfit for service under present standards, which means that in case of a future national emergency he might be able to serve in one of the lower physical categories.

In the case of a regimental officer a verdict of unfit for general service usually means a grant of sick leave on full pay up to twelve months in ordinary cases, and eighteen months in special cases. (See Royal Warrant Art. 435.) A departmental officer is only allowed a maximum of twelve months sick leave. (See Royal Warrant Art. 454.) On the expiration of the permissible period of sick leave, if not fit to return to duty, he is placed on half pay.

The proceedings are confidential. Except as laid down in paragraph 221, Regulations for Medical Services of the Army, the findings of a medical board must not be divulged to the person who is being examined. The opinion of any medical board may be reversed by a subsequent medical board. If, therefore, an individual becomes acquainted with the opinion expressed by one medical board, and this is subsequently amended by another, he is very likely to form the opinion that he is the victim of an injustice, and to begin a series of appeals backed by influential and philanthropic persons who are not fully acquainted with the facts of the case, but whose kindly efforts provide much occupation for the military authorities.

The above notes are, to a considerable extent, also applicable to medical history sheets, particularly in cases where a soldier dies, either in the service or soon after his discharge therefrom, and the eligibility of the widow for a pension must be decided from the information recorded on Army Form B 178.

In conclusion, it may be permitted to point out that the proceedings of medical boards are filed with the individual's personal documents and on every occasion when any question affecting his career is under consideration, the medical board proceedings may be scrutinized to throw some light on his past Army history. It is, however, in the case of appeals (which are common) against a decision not to award a disability pension or against the finding of a medical board, that the proceedings are subjected to a minute inspection, and the sins of the board stand revealed in all their unblushing nakedness.

Clinical and other Notes.

THREE CASES OF MULTIPLE ABSCESES OF THE LIVER.

BY CAPTAIN H. J. BENSTED.

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HEPATIC abscess due to infection with *Bacillus coli* does not appear to be a very common condition and Rogers in his "Bowel Diseases in the Tropics" in mentioning a very acute case of hepatic abscess due to *B. coli* suggests that the condition had been very rarely described. Text-books too describe abscesses in the liver as part of a general pyæmia from a definite lesion in another part of the body, but not what is apparently a primary condition of the liver or more correctly a condition in which the liver is the only organ which shows a definite lesion. Cases 1 and 2 are of this class, whilst in Case 3 the definite lesion in the mesentery would account for the condition in the liver.

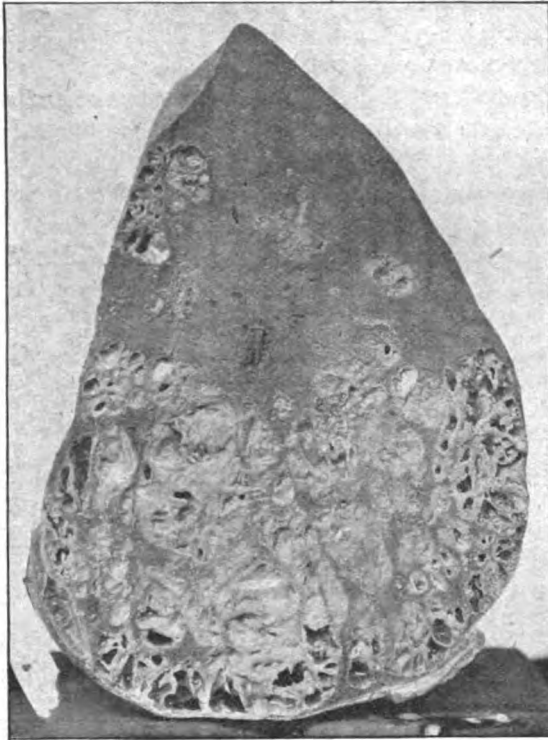
Case 1.—Rifleman J. S., 1/50 K.R. Indian Army. Admitted to hospital with an irregular pyrexia and complaining of a sub-costal pain on the right side. He was found to have a very much enlarged liver and a leucocytosis of 15,000 per cubic millimetre. There was some history of diarrhoea, but repeated and careful examination of the stools failed to demonstrate the presence of cysts of *Entamoeba histolytica* or any pathogenic bacteria. The liver was explored with a needle but pus was not found. Later a definite swelling was felt over the gall bladder and an open operation performed for the drainage of the bladder. The bile was purulent and cultures taken at the operation gave pure growths of the *B. coli*. For several days the drainings were examined, but there was no evidence of the *E. histolytica*. There was some temporary improvement in the condition of the patient, then the disease progressed again and soon ended fatally.

Post mortem the liver was found to be enormously enlarged, the lower border extending well below the umbilicus. The anterior surface of the organ appeared to be comparatively normal, but when it was removed from the body it was seen that the whole of the dome was covered with numerous abscesses just under the capsule. On section the liver was markedly bile stained and the large number of abscesses, so opened, exuded thick pus also deeply bile-stained. The accompanying photograph was taken from this specimen and gives a very fair idea of the liver in section. Cultivations were very carefully taken from several abscesses and all gave pure cultures of *B. coli*.

Beyond a terminal pericarditis no other abnormality could be seen. The

whole of the gut was carefully examined, but there was no evidence of ulceration at all.

Case 2. Indian 2/97 Deccan Infantry. Admitted to hospital with an irregular pyrexia and an enlarged liver and spleen. Blood films failed to show any malarial parasites, but instead a very definite polymorphonuclear leucocytosis was seen. Blood culture was negative and frequent examinations of the stools were repeatedly negative for cysts, etc. Needling of the liver failed to show any pus. The disease progressed more rapidly than



the previous case and terminated fatally. Emaciation was also more marked.

The post-mortem findings of this case were almost identical with the first case, with the difference that the liver was not nearly so large and the suppuration not so advanced. Cultures yielded pure growths of *B. coli*.

Case 3. Pte. W., British Army. This case was admitted to hospital with abdominal pain and pyrexia. A definite peritonitis developed. The abdomen was opened and pus found free in the abdominal cavity. The appendix was normal and there was no sign of a perforation. The liver was seen to be enlarged, but no obvious cause for the peritonitis could be found. The cavity was drained and the wound closed round a tube. The condition

of the patient did not materially improve, but gradually became worse and ended fatally.

Post-mortem examination showed about a pint of bile-stained purulent fluid in the abdominal cavity, together with a plastic peritonitis, matting the whole of the small intestine together. There was a right-sided fibrinous pleurisy at the base with marked diaphragmatic adhesions of recent origin. The liver was much enlarged and showed the same characteristics as the two previous cases. The condition had reached about the same stage as Case 2. The mesentery of the small intestine was shortened and the contained glands were in an advanced state of suppuration forming almost a single bag of pus. The small intestine was very congested, but was not perforated and neither that nor the large bowel showed any definite lesion. Spleen, kidneys, pancreas, etc., appeared to be normal. Cultures from the liver abscesses and the pleural pus gave pure growths of *B. coli*.

The post-mortem examinations in Cases 1 and 3 were performed within eight hours of death and in Case 2 just over twelve hours.

I have to thank Colonel Sir Matthew Fell, K.C.B., A.M.S., Deputy Director of Medical Services, British Forces in Turkey, for permission to publish these notes, and Lieutenant-Colonel Marrian Perry, O.B.E., R.A.M.C., Professor of Pathology, Royal Army Medical College, for help and advice.

A CASE OF INFECTIVE ENDOCARDITIS DUE TO PFEIFFER'S BACILLUS.

BY CAPTAIN H. J. BENSTED.

Royal Army Medical College.

THE literature of influenza contains comparatively few references to endocarditis as a complication. McCallum, in his study of pneumonia in the U.S. Army Camps in 1917-18, records only two cases of infection of the endocardium out of sixty post-mortem examinations. One was a pneumococcal infection of the aortic valve, and the other probably a streptococcal infection of the mitral valve. He quotes one case from Mallock, in which Pfeiffer's bacillus had been recovered post-mortem from the heart vegetations. The Medical History of the War states that the endocardium was rarely affected in post-mortem examinations of fatal cases of influenza, but mentions Mallock's cases, and the fact that one or two others had been reported. On the other hand, Sir Thomas Horder, writing in Price's "Medicine," definitely mentions Pfeiffer's bacillus as a cause of infective endocarditis, and states that in forty cases of this disease in which organisms had been grown from blood culture taken during life streptococci were found in twenty-six cases, pneumococci in five, Pfeiffer in five, gonococci in two, staphylococcus in one and an unclassified bacillus in

one. Again, in discussing the sub-acute form of the disease, Sir Thomas states that the infecting organisms "are the streptococcus, Pfeiffer's bacillus and occasionally the pneumococcus."

The following few notes of a case of sub-acute infective endocarditis are published in the hope that they may be of interest.

Pte. J., aged 25, reported sick with pains in the chest, cough and general weakness.

History.—Never had rheumatic fever in any form, nor any other serious illness. Definite attack of influenza about two months previously. Although he was "about" fairly quickly after the attack he was never really well, and the least exertion tired him excessively. He had pains in the chest and was troubled with a cough.



The patient was admitted to hospital and thoroughly investigated. He was found to have a capillary bronchitis and a diagnosis of infective endocarditis was also made. The patient's condition steadily declined: the pyrexia became very irregular, pleural effusion developed, and later meningeal and cerebral symptoms showed themselves. The disease ended by sudden death.

Blood cultures which were taken soon after the patient's admission to hospital were negative. The blood count rose to 15,000 white blood corpuscles per centimetre, with 85 per cent polymorphonuclears. Lumbar puncture, at the commencement of the cerebral symptoms, produced a clear fluid under pressure.

Post-mortem Examination. — Thyroid normal, œsophagus normal. Aorta, well-marked aortitis, especially at the beginning of the ascending

arch. Trachea, severe tracheitis in the lower part, with blood-stained mucus welling up from the bronchi. Bronchial glands, acutely inflamed, soft. Pleural cavity, about one pint of clear straw-coloured fluid removed from each side of the chest. The pleural surfaces of the lungs were covered with patches of shaggy lymph; this was more marked on the right side and between the lobes. The lungs themselves were very bulky and congested. There was a very fine bronchitis distributed throughout with minute areas of lung involvement. Heart: About 6 oz. of clear fluid in the pericardial space. The pericardial surfaces were smooth, but a few petechial hæmorrhages could be seen just beneath. The heart itself was much enlarged. The right side was dilated, with very thin walls, but the valves and the endocardium appeared to be normal. The left side was hypertrophied with walls about twice the usual thickness. The mitral valve was œdematous, and the edges of the cusps were thickened. The anterior and inner cusps of the aortic valve were eroded right through, and enormous cauliflower vegetations were heaped up round the erosions. (cf. illustration). Liver: Enlarged and actively congested. Spleen: Enlarged and very soft, but pale. Kidneys: Suprarenals, pancreas and intestines appeared to be normal. Brain: Very congested, with flakes of lymph scattered over the vertex, with a collection of semi-purulent fluid in the pia-arachnoid in the sub-occipital region. The right lateral ventricle was slightly distended with fluid. The cerebral arteries appeared to be normal, and there was no evidence of any hæmorrhage. Histological examination showed infection of the brain substance, but satisfactory preparations were not obtained, and it was not possible to demonstrate any organisms.

Cultures were taken from the cerebro-spinal fluid, pleural fluid, heart, vegetations and spleen. The cerebro-spinal fluid was contaminated and the pleural fluid culture showed only a very occasional colony of Pfeiffer with very large numbers of a hæmolytic streptococcus, but cultures from the heart, vegetations and the spleen gave pure growths of Pfeiffer's bacillus.

I have to thank Colonel J. C. Kennedy, C.B.E., R.A.M.C., Consulting Physician to the British Army, for clinical notes and other help; Lieutenant-Colonel Marrian Perry, O.B.E., R.A.M.C., Professor of Pathology, Royal Army Medical College, for the photograph shown; and Colonel Sir Matthew Fell, K.C.B., A.M.S., Deputy Director of Medical Services, British Forces in Turkey, for permission to publish these notes.

Editorial.

THE OFFICIAL MEDICAL HISTORY OF THE WAR.

IN the eleven volumes of this work, the first Medical History of any of the combatants to be completed, the lessons of the Great War are recorded.

The History serves as a link between the civil and military members of the medical profession, and includes the work of Regular, Territorial and Temporary Officers. It will undoubtedly prove to be of great value to medical officers of all armies.

Every administrative medical officer who studies the volumes dealing with administration will find therein information on military medical problems under almost every conceivable condition and the specialist will find in the volumes dealing with his speciality a textbook he cannot afford to neglect.

Now that the last volume of the "Official Medical History of the War" prepared under the general editorship of Major-General Sir William Macpherson has been reviewed in our columns it may be of interest to give a short account of the organization necessary for the compilation and publication of this extensive work.

As far back as the close of the Crimean War the writing of a medical history of the campaigns in which Great Britain had been engaged was proposed by the Director-General of the time, and early in the days of the Great War the necessity of compiling a full and comprehensive official record of the achievements of the Medical Services was recognized.

The first move, however, was made by a civilian, Professor J. G. Adami, F.R.S., then of McGill University, Canada, who, as Colonel Adami, of the Canadian Army Medical Service, served throughout the war, and is now Vice-Chancellor of Liverpool University.

On September 25, 1914, Colonel Adami wrote to Sir William Osler on the subject; Sir William Osler forwarded the letter to the Director-General, A.M.S., at the War Office, and on November 11, Sir Alfred Keogh appointed Captain F. S. Brereton, a retired officer of the Royal Army Medical Corps, holding a temporary commission from the outbreak of war, to collect material for a medical history, and instructions were issued to send the war diaries of medical units and administrative medical officers to him at his office in London.

Shortly after Captain Brereton's appointment the organization of the Medical Research Committee was placed—through the good offices of Sir Walter Fletcher, the Secretary—at the disposal of the Army Medical Services to assist in the preparation of statistics.

Sir Walter Fletcher himself organized the statistical department under

Dr. John Brownlee in London, to whom all statistical records and medical case sheets of all medical units at home and overseas were sent for arrangement and scientific analysis.

All problems connected with the scientific investigation of war injuries and diseases were referred by Sir Walter Fletcher to the Medical Research Committee, who published the results of their investigations in a series of monographs which were distributed throughout the Medical Services.

Sir Walter Fletcher and Captain Brereton—who had been appointed joint Secretaries for the Medical History, with the technical assistance of the Medical Research Council—undertook the work of collecting material of scientific and historical interest, which finally resulted in the formation of the War Office collection of pathological specimens and the Medical Section of the Imperial War Museum.

As the Army Medical College was not then in a position to deal with the collection, the Council of the Royal College of Surgeons of England agreed to place their museum staff and workrooms at the disposal of the Army Council for the preservation, classification and registration of the numerous wet and dry specimens, drawings, paintings, X-ray plates and photographs, illustrating the diseases and injuries incidental to the war, and demonstrating the advances made in plastic surgery, especially in the treatment of injuries to the face and jaw, ophthalmology and orthopædics. The work of preparing, arranging and describing the pathological material was entrusted by the Council of the College to Professor S. G. Shattock and Mr. C. F. Beadles, the Assistant Pathological Curator.

In connexion with the general history as distinct from the scientific work undertaken by the Medical Research Committee, Captain Brereton was authorized to go to France and freely visit the various battle areas in search of information, and to collect sketches, plans, photographs and objects of historical interest, and to direct the construction of models illustrating the work of the Medical Services.

This work developed rapidly, and in November, 1918, a fixed war establishment, with Major Brereton as officer-in-charge, and nine Royal Army Medical Corps non-commissioned officers and men, was authorized for the Office of the Committee of the Medical History of the War and Army Medical War Museum. After January, 1920, the museum was definitely separated from the Medical History of the War, and the work was carried on by Major Brereton, who was, however, retained on the Committee of the History until he resigned in November, 1920.

The first Consultative Committee for the study of the subjects treated in the Medical History of the War was appointed by Sir Alfred Keogh in November, 1914. It met for the first and only time on March 9, 1915, Sir Alfred Keogh himself taking the chair.

The work of the Medical History was then divided into two sections, the one dealing with the statistics of sick and wounded on the various fronts and with case sheets and the collection of material relating

to disease and wounds; the other dealing with the narrative of the war from the medical point of view, and with the museum, which later formed the medical section of the Imperial War Museum. Although the Committee never met again it was never officially dissolved.

It was not until December, 1918, that the successor to the first Committee was appointed by the Director-General, Lieutenant-General Sir John Goodwin.

The members of the new committee were: Major-General Sir W. G. Macpherson, K.C.M.G., C.B. (Chairman), Sir William Osler, Major-General Sir W. B. Leishman, K.C.M.G., C.B., Colonel Sir W. H. Horrocks, K.C.M.G., C.B., a War Office Representative (A.M.D.2), Major F. S. Brereton, C.B.E., Sir Walter Fletcher, K.B.E., Major-General Sir A. Bowlby, K.C.B., K.C.M.G., K.C.V.O., Major-General Sir W. P. Herringham, K.C.M.G., C.B., Colonel T. R. Elliott, C.B.E., D.S.O., Colonel Sir T. Crisp English, K.C.M.G., Dr. John Brownlee.

In October, 1919, Lieutenant-Colonel Brereton handed over the whole of the office and documents for the Medical History of the War, but remained in charge of the Army Medical War Museum in a different office and without any further connexion with the Medical History of the War.

Major-General Sir W. G. Macpherson, as Editor-in-Chief, was left to conduct the general business and correspondence of the Medical History, and carry through the actual preparation and editing of the elaborate and scientific treatises and to write the "Volumes of the General History." The following editorial sub-committees were appointed, each of which decided what aspects of its subject should be treated, and selected the writers:—

Medicine.—Major-General Sir Wilmot Herringham, Sir William Osler,¹ Colonel T. R. Elliott, and Lieutenant-Colonel A. Balfour.²

Surgery.—Major-General Sir Anthony Bowlby, Colonel Sir T. Crisp English, and Major-General Sir Cuthbert Wallace.

Pathology.—Major-General Sir William Leishman and Colonel S. L. Cummins.

Hygiene.—Colonel Sir William Horrocks and Colonel W. W. O. Beveridge.

Statistics.—Dr. J. Brownlee and Major W. R. Galwey.

The Editorial Committee allotted the volumes as follows:—

"General History of the Medical Services," four volumes.

"The Diseases of the War and the Medical Aspects of Aviation and Gas Warfare," two volumes.

"The Surgery of the War," two volumes.

"The Hygiene of the War," two volumes.

"Pathology and Medical Research during the War," one volume.

¹ Died.

² Appointed June 18, 1920.

"The Medical Statistics and Epidemiology of the War," one volume.¹

Major Mitchell, R.A.M.C., was appointed assistant to the Editor-in-Chief in January, 1920. Previous to his appointment Major W. R. Galwey, R.A.M.C., in addition to his other duties in the War Office, assisted General Macpherson.

Meanwhile, the work of the Central Office had developed enormously. In addition to over 38,000 war diaries sent in by medical units on all fronts, the office received at the end of the war great numbers of reports, administrative files, and miscellaneous papers relating to the medical services. The storage, filing, and indexing of the vast accumulation of papers was in itself no small achievement. The war diaries were arranged according to the fronts from which they were sent. Those from commands and units in front areas were then divided from those of units at the base, and subdivided according to their formations, beginning with the highest. The diaries of each unit were arranged in order of time and the units in numerical order.

In April, 1920, it was found necessary to reorganize the staff of the office and for this purpose the assistance of Miss Dugdall, the head of a large typing and secretarial school in Edinburgh, was obtained, and under her advice the office was organized on a more efficient and economical system.

As the work of typing and preparing for the press of articles sent in by contributors progressed the clerical staff was gradually reduced from fourteen in September, 1920 to seven in September, 1922.

By April, 1923, all the technical volumes had been published except that on Pathology which came out in September, 1923.

From the historian's point of view the war diaries were of very unequal value. The most useful were those which gave sketch maps, details of the position and work of the medical units and changes in organization and policy. Many were quite useless because the exact location of the unit was left out or entered as "in the field," and no mention was made of moves, dates of movements, the dates on which officers took command or even of their names.

A most valuable scheme of recording medical administration and operations was instituted in Mesopotamia in accordance with Field Service Regulations (Medical, India). All medical administrative officers in charge of formations were responsible, at stated intervals, for writing a detailed narrative of the medical work in their formations. These records were of the greatest assistance in preparing the chapters on the campaign in Mesopotamia.

When the Medical History came to be written by General Macpherson and his staff, the documents were examined, and those likely to be of use classified according to the subjects dealt with. Each subject under the six main headings—History, Medicine, Surgery, Hygiene, Pathology, and

¹ This volume was not proceeded with as the material could not be prepared within the period allotted for the completion of the history.

Sanitation—was classified and given a number and subject numbers according to the several technical subdivisions; for example, under History I was the Preparation of Medical Services for War; under History II Mobilization and Recruiting for the New Armies; and under History III Landing in France and so on. For convenience of reference, a card index was made and all the documents were indexed under the subject headings.

The different aspects of the technical subjects were not separately indexed, all references to medicine, surgery, and the rest being given together under the main subject heading. Thus everything relating to one subject could be seen on the index card, and at the same time the references showed clearly which aspect of the subject was dealt with.

For the payment of contributors to the Medical History, the Treasury sanctioned the sum of £2,500, as suggested by the Committee. At the same time it was laid down by the War Office that those in receipt of Army pay at the time of writing their articles must receive no further remuneration from the Medical History. This for the time being made the calculation of the rate of pay impossible, and the Editor-in-Chief could only allocate provisionally £250 for each of the ten volumes, assuming that two volumes of the General History, being written entirely by himself, would require no contributions.

The Editor-in-Chief himself, in fact, eventually compiled the whole of the first three volumes of the General History and part of the fourth; the greater part of the latter, however, was written by Major T. J. Mitchell. A surplus was thus provided which enabled the Treasury to extend the period for the completion of the History to September, 1923, without adding to the original grant.

When the selected writers were invited to contribute to the technical volumes, no definite rate of remuneration was promised, and it was only after the first volume had been published that the Editor-in-Chief was able to calculate that he could pay the writers at the rate of 10s. a page, and have a margin of safety over from the £250 allotted for the volumes. Contributors were selected in the first place by the Editorial Sub-Committee, and the names, together with the scheme of chapters, were submitted to the General Committee.

To facilitate the supply of information to contributors, the Editor-in-Chief provided pigeon-holes for each subject in which all the documents, as they became available, were placed, and the writers were invited to come to the office and study the material there, a shorthand writer being placed at their disposal for the purpose of making extracts.

The Editor-in-Chief had to make the final decision regarding the form and order of the chapters sent in, a matter of considerable difficulty owing to frequent changes and the necessary pruning of overlapping descriptions. Endeavours were made by the Editor-in-Chief to render them uniform and in doing so he was ably assisted by the skill, hard work and enthusiasm of

Miss G. M. Smith, M.A., without whose help in carrying out this somewhat tiresome task, the History could not have been finished within the period allotted.

After the Treasury had sanctioned the above expenditure on the Medical History, it was estimated that the cost of publishing the work would be about £1,500 per volume and the total cost approximately £16,500. The Army Council agreed that it should be published by H.M. Stationery Office who should issue each volume as it was completed.

The stages through which the volumes passed before publication necessitated the reading and re-reading by the contributors and the sub-editors, of no less than five proof forms of each manuscript. After the manuscript had been read and corrected by the subject Editors, it was read by the Editor-in-Chief to whom revised galley proofs were subsequently submitted, and finally all page proofs were read by the Editor-in-Chief and by the Secretary.

All arrangements for the preparation of blocks and plates for the different illustrations and maps were made by H.M. Stationery Office and the final proofs were submitted to the Editor-in-Chief and were not passed for publication without his approval. Many of the blocks were lent by various journals, by publishing and other firms, and by private persons, free of charge, and their loans are acknowledged in the preface of each volume in which such illustrations appear.

The photographs illustrating the four volumes of the general history were obtained from official and private sources and were acknowledged in the prefaces of the different volumes.

Nearly all the maps attached to war diaries, many of which were prepared from sketch maps, and most of the charts, diagrams and line illustrations, were drawn in the office by Mr. J. J. Bishop and Miss M. Ross and they represent much time and labour in examining documents and publications.

In this connexion it may be mentioned that the want of any organization for collecting and preserving the maps used during the course of the war made the task of preparing records needlessly difficult.

The total sum—exclusive of the Assistant Editor's pay and allowances for office expenditure, stationery and publishing—allotted by the Treasury for the work of compiling the Medical History was £16,800, of which £2,500 might be expended for the grant of honoraria to the writers of special articles who were not in receipt of Army Pay. £2,500 a year was allotted for the payment of the necessary subordinate staff and a yearly salary of £600, in addition to his retired pay, was allotted to Sir William Macpherson as Editor-in-Chief from the date of his appointment in September, 1919.

It was originally stipulated that the work should be completed within three years from September, 1919; for various reasons however, it was impossible to comply with this condition and the time limit was extended

to September, 1923, on the understanding that no further grant would be made by the Treasury. Subsequently, however, the Treasury granted an additional £200 and again extended the time limit until August, 1924.

Sir William Macpherson's term of office expired on 31st August, 1923, and Major Mitchell was left in charge of the office and to supervise the publishing of Volumes III and IV of the General History.

On the publication of the last volume the office was demobilized and under War Office instructions the war diaries were sent to the Historical Section of the Committee of Imperial Defence, the hygiene documents to A.M.D.5, the pathology documents to A.M.D.6, and all other records, original MSS., etc., were sent to Isleworth to be kept for reference if necessary.

Current Literature.

Chlorine as a Therapeutic Agent in Certain Respiratory Diseases. By Lieutenant-Colonel E. B. Vedder, M.D., and Captain Harold P. Sawyer, M.D., Medical Corps, United States Army (*Journal of the American Medical Association*, March 8, 1924, vol. lxxxii).—They point out that Küster (*Deutsch. med. Wochenschr.*, September 9, 1915) states that, in 1915, inhalations of chlorine were used successfully to clear up meningococcus and diphtheria carriers and that Hale (Hale, Harrison, *Journal of Industrial and Engineering Chemistry*, xii, 806, August, 1920) used chlorine in unknown concentration at the University of Arkansas during the influenza epidemic, and believed that students who took this treatment suffered less from influenza than others, and that employees in plants producing or using chlorine have always believed themselves to be relatively free from respiratory diseases, which was borne out by the experience at the Edgewood Arsenal when the great epidemic struck that post. It is stated that no cases were recorded among the operatives of the chlorine plant, although every other organization of the Arsenal had its full quota of cases.

They, therefore, determined to investigate the value of chlorine as a therapeutic agent.

They first determined the concentration of chlorine required to kill certain bacteria by inoculating a series of agar plates inoculated in duplicate with the different organisms to be tested, exposing one of each for a given time to a known concentration of chlorine in a continuous flow chamber, using the others as controls.

As soon as exposure was completed, the plates were incubated and observed for several days.

It was found that the different bacteria used were all killed by a concentration of 0.021 milligramme of chlorine per litre if the time of exposure was sufficient, and that the more delicate organisms, e.g., *Micro-*

coccus catarrhalis and the meningococcus, were killed after an hour's exposure to this concentration. This concentration of 0·021 milligramme of chlorine per litre is well within the limit of safe exposure.

The effect of inhaling chlorine on the bacteria of the naso-pharynx was next tested. Swabs of the naso-pharynx were taken in the usual way and rubbed over a surface of three square inches on an agar plate. The patient then inhaled chlorine of a concentration of approximately 0·02 milligramme per litre for an hour, at the end of which time the naso-pharynx was again swabbed and cultures taken in a similar manner.

About fifty cases were examined in this manner with practically uniform results. Abundant growth was secured on the first plate whilst the second remained sterile or at most developed a few scattered colonies. Further experiments showed that a treatment of half an hour did not materially diminish the growth in the second culture; forty-five minutes exposures appeared sufficient practically to sterilize the tonsillar, post-nasal and pharyngeal surfaces.

They pointed out that chlorine is an active germicide in aqueous solutions in concentrations of 1 part per million and as 0·02 milligramme per litre of air is approximately equivalent to 20 parts per million of air and as chlorine is readily soluble in water it is evident that concentrations of 1 part per million and higher may be reached easily in the fluids bathing the respiratory tract when chlorine is passing continuously over them for an hour. On the other hand, chlorine would probably have little or no penetrating power and could hardly be expected to sterilize tonsillar crypts or deep-seated infections.

They then tested the actual effect of inhalation of chlorine on patients suffering from infections which they thought might be amenable to this treatment. For this purpose they constructed an air-tight chamber 13 feet by 13 feet by 10 feet, in which five or six people could sit comfortably, and through which 42,000 litres of gas-air mixture could be passed a minute.

They used a concentration of 0·015 milligramme per litre of chlorine, as it was found that 0·02 caused slight irritation of the throat. The results are shown in the following table:—

Disease	Number of cases	Cured		Improved		No change	
		Number	Per cent	Number	Per cent	Number	Per cent
Coryza	388	288	74·2	91	23·5	9	2·3
Acute laryngitis and pharyngitis	127	99	78·0	24	19·0	4	3·1
Acute bronchitis	241	192	80·0	47	19·5	2	0·5
Chronic rhinitis	106	33	31·1	41	38·6	32	30·2
Chronic bronchitis	47	34	72·3	12	25·5	1	2·1
Chronic laryngitis	2	2	100·0				
Whooping cough	9	8	88·8	1	11·1		
Influenza	11	9	81·8	2	18·1		

Most of the patients received a single treatment of one hour. A few received a second or even third treatment on succeeding days, and a table

is appended to the original article which gives this and the results obtained in detail.

They consider that such chlorine treatment will completely abort a cold when taken sufficiently early, and in well developed cases it affords great relief. Acute bronchitis is practically always relieved. There is more difficulty in treating "head colds," because the swelling of the mucous membranes stops the air passages and prevents free access to the chlorine. In a number of their later cases the nose was first treated with epinephrin in order to shrink the mucous membranes and obviate this difficulty, but they do not state the result achieved.

Their cases of influenza and whooping-cough were too few to afford a basis for positive statements, but they are inclined to believe that chlorine will be as effective as in the case of common colds. This is especially the case in whooping-cough; the results in the treated cases were very pronounced. After one or two treatments children who had had numerous daily paroxysms, followed by vomiting, and were losing weight, after one or two treatments ceased to vomit and the paroxysms were greatly reduced in number.

Two of the cases were in adults, and were undoubtedly cured, as the paroxysmal coughing ceased entirely following several treatments.

As the use of chlorine gassing chambers is impracticable for general use, they evolved a method of administration for use by any physician in an ordinary room.

A portable apparatus, by means of which measured quantities of chlorine could be released, was produced by the Wallace and Tiernan Company in New York. This is depicted in the article and seems simple in design, but its cost is not stated.

In practice it was found that the concentration in the room could be regulated by the subjective sensation of the patients; slight irritation of the throat appears in normally sensitive persons when a concentration of 0.02 milligramme per litre is reached.

Since obtaining this apparatus ninety-three persons have been treated in ordinary rooms, the results comparing very favourably with those obtained in the chamber experiments.

In the concentration specified the chlorine appeared to have no bad effects on fabrics or metals in the rooms.

Urobilin and Malaria.¹ Marinestabsarzt Dr. Ballerstedt (*Archiv für Schiffs- u. Tropenhygiene*, 1924, 3, p. 100).—The excretion of urobilin in stools and urine is a characteristic feature of a malarial attack. This was first stated by Grimm in 1893. The amount of the excretion varies with the severity of the attack, though not with the temperature of the moment, for it occurs in the cold stage and is at its greatest after the temperature

¹ An article on this subject by Major W. E. Home, R.A.M.C., appeared in the *JOURNAL OF THE ROYAL ARMY MEDICAL CORPS*, vol. xxxvii, No. 6, December 1921, page 463.

has begun to fall. It is the same for all the kinds of malaria parasites, and is in no relation to their stage of development (rings or crescents, for example, make no difference), or to the readiness with which they can be found in the blood films. Hildebrandt, in 1909, noted that the highest values occurred in a blackwater fever of which Sorensen, in Java in 1914, found it might be a pathognomonic precursory symptom. Excretion is highest in first attacks, lower in relapses, and gradually falls during convalescence, but always more slowly in the stools than in the urine, ceasing perhaps in a week, perhaps lasting for months. Present in small amount it does not prove malaria unless there be some other sign, as splenic enlargement or monocytosis. It is formed mainly in the intestine by the reduction of bilirubin, and its increase argues red blood corpuscle destruction, though the percentage of hæmoglobin remains unchanged at eighty to ninety per cent. Unless the liver is out of order urobilin is eliminated mainly in the stools; excretion by the urine may be relatively slight. It is the excessive formation of urobilin in the intestine, absorbed into the blood and carried to the liver, which in chronic malaria causes the liver to hypertrophy and by stretching its capsule originates the characteristic pain at the liver edge. Urobilinogen is to be recognized by Ehrlich's test (dimethyl-amidobenzaldehyd), and is at first excreted in quantities roughly parallel with those of urobilin; another indication that the clinical condition of the patient is due to malaria.

Staff-Surgeon Ballerstedt's paper gives full detail for the quantitative measurement of urobilin in the urine and in the fæces.

Alcohol: Its Action on the Human Organism. (A Report issued by the Medical Research Council.)—

By "alcohol" is meant ethylic alcohol and it is this substance which is responsible for almost the whole action on the body which distinguishes alcoholic from non-alcoholic drinks and is the main reason for their use.

In regard to the value of alcohol as a food, it is shown that alcohol is absorbed rapidly and completely by the stomach and small intestine and reaches a maximum concentration in the blood in $\frac{1}{2}$ to 2 hours; absorption is more rapid when taken concentrated, on an empty stomach, or as distilled spirits. Except in habitual drunkards, it has little effect on digestion other than increasing the secretion from the stomach wall, but some beverages have a more deleterious effect than others owing to the higher alcohols (fusel oil) and ethers contained in them. A small proportion of the alcohol absorbed is excreted in the breath and urine and the rest is oxidized in the body: none is converted into any substance which the body can retain. Alcohol can serve as a fuel for the body but is available only for immediate use and cannot be used to form new materials for the body's fuel reserve. Within limits it can replace an equivalent amount of carbohydrate or fat in the diet and also can act as a "protein sparer," in fact, the whole value of alcohol as a food is due to its use by the body as an immediate fuel.

With regard to the action of alcohol on the various systems of the body, its chief action is that of a narcotic drug acting on the central nervous system and all the symptoms of drunkenness are due essentially to the action of alcohol on the central nervous system. It successively weakens and suspends the functions of the brain in the inverse order of their development; self-criticism, and therefore self-control, being the highest and latest developed is the first affected. The initial feeling of well-being and comfort is due to flushing of the skin and blunting of sensibility. If the drinker is subjected to the stimulation of social intercourse he will pass through a stage of excitement proportional to his temperament and the degree of the external stimuli.

The fatal dose of alcohol for a man of 10 stone is 14 ounces of absolute alcohol, that is $1\frac{1}{2}$ pints of proof spirit or over 2 gallons of beer. Any form of alcoholic beverage can cause drunkenness if such a quantity of it is taken at once as will give a concentration in the blood of 0.15 to 0.2 per cent alcohol; use of more diluted beverages therefore is a factor in prevention of drunkenness.

The action of alcohol on the respiratory system is of no practical importance, neither does it act as a direct cardiac stimulant, so in promoting recovery from fainting it acts only by irritation of the buccopharyngeal mucous membrane in the same way as sal-volatile or burnt feathers.

The action of alcohol on muscular action is important. It acts on the nervous mechanism enervating the muscle and not on the muscle fibres themselves. Various workers using different tests and ergometers have shown that the accuracy of muscular movements is impaired after taking alcohol, the effect varying with the susceptibility of the subject, amount taken, and conditions under which taken: in other words, alcohol reduces the trained man to the level of the untrained.

As regards its effect on temperature, alcohol causes loss of heat through flushing of the skin and blunts the warning sensation of cold: therefore the taking of alcohol before or during prolonged or severe exposure to cold is to be condemned. When, however, the exposure is at an end and the person placed under conditions promoting warmth, alcohol assists restoration by promoting the return of blood to the superficial tissues.

In chronic alcoholism it is noted that effects occur from chronic gastrointestinal catarrh, failure of the digestive juices, and absorption of poisons from the alimentary tract.

Although the nerve cells may acquire tolerance to alcohol, the other body cells cannot accommodate themselves, and become injured, so that drunkards are likely to suffer eventually from bodily disorders. In chronic alcoholics some affection of the mind is present, but alcoholic excess plays little part in the causation of ordinary mental disease. The reproductive system and progeny of chronic alcoholics are affected: in males there is wasting of the testicles and absence or scanty production of spermatozoa,

while in females there are similar alterations in the ovaries; the offspring are inferior in strength and vitality and this may be more apparent in later generations.

The conditions promoting chronic alcoholism are stated to be use of stronger beverages, frequent repetition of dose, drinking without food, and sedentary occupation.

Unlike morphine and some other drugs, no high degree of tolerance is acquired by the prolonged use of alcohol, and cutting it off abruptly in a heavy drinker does not necessarily precipitate an attack of delirium tremens as popularly supposed.

As regards alcohol and longevity, official statistics and those of assurance societies show the death rate is lower and expectation of life greater for total abstainers, while there is an exceptionally heavy mortality among persons occupied in the liquor trade. Lastly, in regard to alcohol as a medicine, it is shown that when properly used it is a genuine therapeutic agent. Its main value is due to its narcotic action, in association with which its limited food value may be of use when ordinary nourishment cannot be taken. It also aids the application of external warmth in warding off or abating the effects of common catarrhal infection known as "chill."

G.S.P.

Note on the Effect of Inoculation of Heterologous Antigens on a Steady Agglutination Titre. A. B. Rosher (*Lancet*, July 19, 1924).—This note is written with the object of assisting in the elucidation of the problem of the diagnosis of enteric fevers in inoculated subjects. It has been suggested by Garrow and others that infections which have no relationship to enteric might increase the production of specific agglutinins in the immunized subject, thereby giving rise to errors in diagnosis.

A number of experiments were carried out, according to Dreyer's technique, for the estimation of agglutinins, the dilutions being put up in geometrical series. A rabbit, with a steady agglutination titre for *Bacillus coli* of 1/80, was inoculated with a large dose of *Staphylococcus aureus* vaccine without affecting the titre for *B. coli*. A similar result followed the use of sheep's red corpuscles as heterologous antigen. The administration of mixed catarrhal, gonococcus and *B. coli* vaccine in repeated doses to a rabbit immunized against *Bacillus paratyphosus* A showed in no case more than 100 per cent fluctuation in titre, i.e., one dilution higher or lower. *B. paratyphosus* B given to an animal having a steady titre for *Bacillus typhosus* likewise gave negative results. However, when *B. paratyphosus* C and *B. paratyphosus* B were used as primary and secondary antigens the titre for *B. paratyphosus* C was raised from 1/320 to 1/5120 in seven days. In view of Andrews' work it is noted that the bacterial suspensions used were not differentiated as specific or non-specific. Rabbits immunized with *B. paratyphosus* A and *Bacillus enteritidis* (Gaertner) and subsequently subjected to severe constitutional disturbance

by infection with *Pasteurella muris* and *Bacillus tuberculosis* respectively showed no appreciable agglutinin fluctuation.

The writer concludes that the only instance in which the titre was appreciably affected was when the non-specific antigen bore close serological relationship to the specific one, and these results support the reliability of the repeated agglutination method in the diagnosis of enteric in inoculated subjects.

C. J. C.

Reviews.

HISTORY OF THE GREAT WAR. MEDICAL SERVICES GENERAL HISTORY (Vol. IV, xvi + 711). Published by H.M. Stationery Office. 1924. 25s. per volume, net. Obtainable at H.M. Stationery Office, Imperial House, Kingsway, London, W.C.2, or Messrs. Thacker, Spink and Co., Calcutta and Simla.

This remarkable volume, the last of an instructive and deeply interesting series, concludes the account of British medical efforts during that Great War which convulsed Europe and dragged country after country into its iron meshes. It cannot have been an easy volume to write. It is by no means an easy volume to review. It ranges far and wide. We pass from the sandy gullies and scrub and heath of Gallipoli, with its torrid heat in the summer and bitter winter blizzards, to the bare hills and marshy valleys of Macedonia, with its beautiful lakes and scattered, insanitary villages. We are transported from the burning plains of Mesopotamia to the mountains of North-West Persia and the shores of the Caspian. We plunge into the dense bush of East Africa, wander amongst its forested hill tracts, cross its great rivers, traverse its open country, stifle in its valleys and then find ourselves upon the barren rocks of Aden. Finally we flounder amongst North Russian snows and are ice-bound at Archangel. The book performs much in detail, a detail necessitating close reference work and meticulous accuracy on the part of the authors, but scarcely lending itself to the art of the reviewer.

As indicated, General Sir W. G. Macpherson found it desirable to associate with himself a second author, Major T. J. Mitchell, R.A.M.C., in the preparation of this volume, and in his preface he pays a tribute to the latter, who contributed the excellent chapters dealing with Iraq, East Africa, Aden and North Russia, and also that wherein the various types of ambulance transport employed on the different fronts are very fully described and well illustrated. The services of Major Mitchell as assistant to the Editor-in-Chief during the whole period throughout which the volumes of the Official Medical History of the War have been prepared are also generously acknowledged.

Speaking generally, it may be said that this is a well-written and well-illustrated volume, amply provided with clear and informative maps and plans and carefully and accurately indexed. Its three appendices are concerned respectively with the recommendations of the Committee appointed in March, 1919, to consider the organization of medical services for operations in Mesopotamia, the description of a medical unit of a mobile column in North Russia, and the awards conferred on the personnel of the medical services during the war.

The opening chapter, dealing with the operations on the Gallipoli Peninsula, makes sad reading, but, though a wonderful amount of information has been crowded into comparatively few pages, it may well be doubted if the full story has been told. It must, we think, appear to those who knew their Dardanelles, that sufficient stress has not been laid on the evil influence of Mudros. The island of Lemnos became, was indeed permitted to become, a veritable hotbed of disease, and a great many of the infections which helped to wreck the Gallipoli enterprise had their origin at Mudros itself. It is not surprising, for, with a few notable exceptions, those responsible neglected essential sanitary precautions. The knowledge acquired in the years before the war was cast into the melting pot. We plunged into a campaign without due forethought, without that co-operation between the medical services and the other branches of the army which is so indispensable, and we reaped our reward. How could it be otherwise when, as late as August, 1915, open latrine trenches were the order of the day, and countless flies bred in and batted on their contents? The failure was by no means only due to deficiencies in the medical services, but there can be no doubt whatever that, at the beginning, the best men with the fullest and ripest experience were not at Mudros and not at Gallipoli, and that those in authority were unable to cope with a most difficult and complicated situation. There was apparent, again with notable exceptions, a lack of ingenuity and of energy. Mudros in short was a muddle, and a muddle in war spells tragedy.

This is clearly borne out in other particulars, as, for example, the failure to equip transport for serious cases at the time of the landings at Helles and Anzac, the arrangements whereby the A.D.M.S. Mudros was more or less marooned on that ill-fated ship the "Aragon" and thereby prevented from exercising proper supervision, and the confusion which arose as the result of the appointments of Surgeon-General Babbie and Surgeon-General Sir James Porter.

Apart, however, from these causes of failure there was the lack of training in such combined operations as were necessitated by the landings on the beaches, and the grievous miscalculation by the General Staff, not by the D.M.S., as to the probable extent of the casualties.

We are told the whole story plainly and frankly, and are tempted to wonder if, in operations of this kind, the Medical Services should not be the supreme authorities, in a position to dictate their requirements and

insist on their wants being supplied. So far as disease is concerned, had this been the case, the Dardanelles venture might have proved a military success.

Diarrhoea and dysentery take the heart out of the most gallant of men, and had the Ordnance and the Engineers been under the thumb of the sanitarian and forced at the outset to supply the necessary wood and corrugated iron for the construction of fly-proof latrines and forced also to take adequate measures for safe-guarding water supplies, there might have been a different tale to tell. More than one sanitary officer at Mudros and on the Peninsula well nigh broke his heart trying, as it were, to make bricks without straw.

So far as medical arrangements in the field are concerned, General Macpherson draws an interesting comparison between the attack on Gallipoli and that of the French on Algiers in 1830. Did anyone at the War Office recall and study that campaign? Probably not, just as inquiry has shown that, in all likelihood, the records of the old Nile campaigns were ignored by those who had to make arrangements on the Tigris and Euphrates where the conditions in many respects closely approximated to those encountered in Egypt and the Sudan.

Naturally enough the Editor-in-Chief's account of the operations on Gallipoli suffers somewhat from compression, but he indicates that from the very start there should have been proper hospital accommodation at Mudros, and he handles the whole grim story in a clear and concise manner. It is noteworthy that, for quite a long time, we had to rely upon the French for our laboratory work.

The different actions which took place are briefly described together with the facilities afforded for the collection and transport of wounded and the success or failure which attended them. Stress is laid on the manner in which the arrangement for the classification of the wounded with a view to shipment broke down both at the original landings and at Suvla, while the following quotation suggests the shutting of the stable door after the theft of the steed.

"The medical preparations, consequently, for the large number of casualties that were anticipated during the withdrawal were in marked contrast with the preparations for the original landing on the Peninsula. They were in a way epigrammatic, for at the original landing the medical services were quite unprepared for what happened, whereas at the time of the withdrawal they were fully prepared for what did not."

The chapter concludes with a note on the value of the rest camps and details as to the losses sustained by the R.A.M.C. General Macpherson allows himself more space when dealing with the Macedonian theatre of war, regarding which he also writes with special authority for he was a D.M.S. there for a considerable period and played an important part in furthering the claims of sanitation. The situation in all its various phases, some of which were tragic, is traced from the autumn of 1915, when two

French Divisions from France, one from the Dardanelles, and the British 10th Division disembarked at Salonika, until the Armistice. Thereafter a short chapter takes up the story as it concerns Bulgaria, Turkey, Asia Minor and South Russia.

A brief, yet comprehensive, account of the Macedonian Front paves the way for a consideration of the medical situation, which emphasizes amongst other things the necessity that arose for reconstituting the field ambulance transport to render it suitable for warfare in a mountainous country with few roads adapted for wheeled transport. There is an excellent map showing roads, tracks, and railways, and indicating the medical arrangements for the collection and evacuation of sick and wounded.

Information, supplemented in Chapter XXIII, is forthcoming as regards the use of cacolets, travois, litters, and ambulance trains, and is followed by an account of the casualty clearing stations, the general hospitals, and the relation of the medical and surgical work to the military operations. There is an interesting chart showing the number of beds equipped and vacant, and the number of patients in hospitals from December, 1915, to December, 1918. It indicates what a very small margin of vacant beds was left when malaria became prevalent in the summer and autumn of 1916, but also demonstrates the abundant provision made after that date for battle casualties and cases of sickness. Convalescent depots were a feature in Macedonia, and the high proportion of beds, amounting at one time to more than one-third of the total strength of the force, was due to restricted evacuation and malaria. It had, says the author, no parallel in other theatres of war.

The problem of disease prevention led to the formation of an International Hygiene Committee, which obviously did useful work, though no measures were able to cope successfully with the malaria which broke out after the advance to the Struma Valley. We are told something about the other diseases which were prevalent and the steps taken to combat them. Then follows a chapter on the Medical Services during the battles of the British Salonika Force, clearly written and furnished with good sketch maps, which are a great aid to the reader. As a rule, the arrangements worked well, and difficulties were met but to be overcome. A table of casualties during the 1918 offensive indicates how the brunt of the fighting fell on the British troops.

After the Armistice the International Hygiene Committee formed in Salonika by General Macpherson was reconstituted in Constantinople and acted as a legislative sanitary authority. The chapter dealing with this period throws light on movements and operations about which our knowledge generally has been rather vague.

Nearly 170 pages are devoted to Mesopotamia, and they do justice to one of the most interesting of the eastern theatres of war. After a few preliminary remarks we are introduced to the operations leading to the occupation of Basra and made to realize at once the difficulties with which

the Medical Services were faced—difficulties of terrain, difficulties from climatic conditions, and difficulties owing to shortage of equipment and to the antiquated ideas of the general officer commanding. These were also present when Qurna became the objective, and the last-named, exemplified by the order that "sick and wounded will be carried with the force by those medical units" is stated by Major Mitchell to be contrary to all principles of training and to have been responsible for many subsequent hardships and failures as is, indeed, amply demonstrated in the narrative. Up to April, 1915, the general health of the force was satisfactory, due largely to its victorious progress. The fact that the medical officers were seasoned and experienced also had its due effect, and these officers were fortunate in being furnished with a valuable pamphlet compiled by Colonel Hehir which proved a safe guide in their perplexities. It is noteworthy that no sanitary section accompanied the original force, and that no provision was made for dental needs.

Moreover, the very ease of water transport for sick and wounded by means of bellums, mahelas, and river steamers led to a mistaken idea that fewer field ambulances for the divisions and fewer hospitals for the lines of communication were required for a force operating in Mesopotamia. This and other factors—notably, so far as the actions on the Euphrates were concerned, the lack of co-operation between the divisional A.D.M.S. and the D.D.M.S. at General Headquarters—accounted for the disgraceful conditions under which sick and wounded had to be evacuated. These were of course intensified as the army got further from its base on the way to Baghdad and culminated in the shocking state of affairs after the battle of Ctesiphon. As the author points out no adequate arrangements could be made by the A.D.M.S. of the 6th division with the units at his disposal, but there were two prominent defects in the arrangements for which he and the General Staff were responsible. These were the plans whereby walking wounded were to be evacuated forward into Baghdad, a town still in hostile hands, and the failure to appoint an embarkation medical officer at Lajj.

At the same time the whole of the wounded were got away, an achievement redounding to the credit of all medical officers with medical units and regiments.

The first operations for the relief of Kut included such serious encounters as those of Wadi, Hanna, and Shaikh Saad. The account of the medical situation in relation to these battles makes dismal reading, and the confusion, which was only too apparent, was due in part to the reprehensible method of splitting up medical units at Marseilles, embarking them on different transports and separating them from their formations.

At the same time it is stated that "failures in the medical arrangements were not due to lack of organizing ability so much as to the general shortage of units, equipment and transport from which the force as a whole suffered." In any case the sick and wounded were better treated

and more easily evacuated during these operations than on the previous advance up the Tigris. The D.D.M.S. of the Expeditionary Force, however, is rightly condemned in these strong words: "His lack of co-operation and initiative, and the absence of a forcible policy are outstanding points in the history of the campaign." Those conversant with the inner history of the latter will endorse this verdict.

The chapter on medical arrangements during the siege of Kut, no doubt largely compiled from Colonel Hehir's articles, is of great interest. Here we can only mention the records of frost-bite and trench rheumatism amongst the besieged garrison as showing the complexities of a campaign in a country like Mesopotamia.

The magnificent work of reorganization which, under the leadership of Sir Stanley Maude, was carried out, so far as medical matters were concerned, by Surgeon-General H. F. Treherne and his able and devoted assistant, Colonel M. H. G. Fell, forms the subject of chapter X. It makes inspiring reading, but it must be remembered that a breathing space was vouchsafed to the men on the spot and that Markham Carter's revelations had focused attention on the Tigris front and had so aroused public opinion that the India Office could no longer ignore its claims.

In some ways the story is not unlike that of the Crimea. The situation was saved, and the final advance to Baghdad was made under very difficult conditions. These are fully and carefully described. Indeed, it is remarkable how the huge mass of facts and details has been digested and incorporated into a consecutive and readable account.

Lack of space forbids any close consideration of this section and also of that which follows it and which deals with the occupation of Nasiriya. Medical matters on this front, a much quieter one, were often ahead of those elsewhere, and this was in great part due to the help and sympathy extended to the Medical Services by Brigadier-General Brooking, under whose orders the Euphrates Force operated. There were, of course, other reasons, but the General Officer Commanding and his staff did all they could to combat monotony and to ensure the welfare of the troops with very gratifying results.

There is much that is interesting in the chapters devoted to the Medical Services after the occupation of Baghdad, the operations in Upper Mesopotamia, those on the Euphrates in 1917-18, and the difficulties encountered in North-West Persia, but we can merely direct attention to the diagram of the scheme of the Administrative Services in 1917, which shows how far-reaching the organization became, make mention of those pages detailing the measures adopted to prevent and treat heat-stroke, and indicate the fact, duly recorded, that there were remarkable developments in the way of supplementing the food supply both for the troops and for the hospitals and convalescent depots. Much less space is devoted to East Africa, but if there is less in the way of quantity, the quality of the contribution remains at a high level. We get a very fair idea of what

happened there from start to finish and praise and blame are impartially distributed. As in Mesopotamia, so in East Africa, the general staff was very largely at fault, while there can be no doubt that this theatre of war was to a great extent neglected by the War Office until a year or so before the conclusion of hostilities. It was a kind of water-tight compartment, and the mistakes made elsewhere were repeated in it with a kind of faithful monotony.

One very important point is not mentioned, at least directly, and that is the disastrous policy whereby incoming troops were deliberately dumped down in areas where they were almost certain to acquire malaria.

It was Mudros over again. Our base camps were bad and the fighting man became infected ere ever he saw the front. Those who remember Dar-es-Salaam in the war days know full well that a comparatively healthy site could have been obtained for the main detail camp, and know also why the site was not available. Again, there was for a long time no proper sanitary organization and the scientific side of the Medical Services was woefully neglected.

As a matter of fact the right men were not at first sent to German East Africa, a vicious circle was established, and not all the labours of a Sisyphus could have broken it.

Every one of these campaigns tells the same tale, i.e., a good start means half the battle. We were certainly bad starters in East Africa, and so frittered away many lives and much treasure and gravely endangered our prestige. All this Major Mitchell plainly indicates, paying tribute, however, where he can to good work and devoted service. East Africa was one long struggle against difficulties perhaps greater than existed in any other theatre of war. The evacuation of sick and wounded taxed all our resources, and the magnitude of the scheme in operation by May, 1917, is indicated in a diagram which gives one furiously to think and makes one wonder how many pounds sterling would have been saved had the Germans been crushed as they might have been before General Smuts handed over his command.

These, however, are vain imaginings and the student of military warfare, be he medical or lay, will find much that is suggestive and informative in the eighty-odd pages dealing with East Africa.

Aden need not detain us. Here again we made a mess of things at the start but recovered and carried on more or less successfully. The campaign in North Russia makes more attractive reading. It began in a small way, but the force sent there was, most appropriately, like a snowball, for it increased and increased until it numbered 18,400 men. The medical history of this campaign is, as stated, of special interest "because very many years have elapsed since military operations have been undertaken by British troops in an arctic region."

The Hints and Precautions for Winter Camps and Sledging Operations will assuredly be new to most of those who read this book and suggest Scott or Shackleton rather than a British force in the field.

The arrangements for the evacuation of wounded from mobile columns were of course specialized, and the sledge played an important part in the ambulance transport. The Relay Posts which were established recall tales of Arctic and Antarctic exploration, but railway trains and hospital ships played their parts and reminded those concerned that they were in Europe and not too near the North Pole.

The disease incidence was not excessive. Ordinary coryza was almost unknown and pneumonia was rare. We escaped typhus, and, largely owing to sound preventive measures, dysentery and fevers of the enteric group did not bulk largely. The rations were of good quality and partly at least on this account our troops escaped the acute form of gastro-enteritis so prevalent amongst the civil population of North Russia.

In all the war areas the influence of the dietary was most marked, but perhaps it was most apparent in North Russia where scurvy might so easily have played havoc as it did in the case of the civilian population and amongst the enemy prisoners of war.

We get the impression that by the time the North Russian campaign started in April, 1918, we had learned our lesson, and that, save in some minor matters, and an insufficiency of medical arrangements for the "Syren" force, this adventure was well handled on the medical side.

One of the chief dangers, mental depression from the isolation and monotony of the life, was avoided by limiting the length of service. The maps, diagrams and illustrations materially help one to appreciate the situation.

Mention has already been made of the concluding chapter on ambulance transport. It is a very serviceable record providing information not readily accessible from any other source.

It is devoutly to be hoped that never again will the British Empire be called upon to face such ordeals as those through which it struggled from 1914 to 1918 to ultimate victory. If, however, this unhappily should not prove to be the case, then this final volume more perhaps than any of the series should prove a safe guide in enabling it to avoid those pitfalls into which it plunged time and again during its titanic struggles with the Teuton, the Bulgar and the Turk.

A. B.

PSYCHO-ANALYSTS ANALYSED. By P. McBride, M.D., F.R.C.P.E., F.R.S.E. London: William Heinemann, Ltd. 1924. Pp. vii + 142. Price 3s. 6d.

This book is the result, one presumes, of considerable correspondence in the *British Medical Journal* in the winter of 1922-1923, for and against the Psycho-Analytic School. This correspondence may be remembered by some of the present readers, and was an example of the somewhat regrettable fact that neither the supporters nor opponents of psycho-analysis are capable of giving an unbiased verdict.

Dr. McBride, in the book under review, has presented the case against

the Psycho-Analytic School from a very fair and reasonable standpoint. There is an introduction by Sir H. Bryan Donkin, M.D., F.R.C.P., and the book contains a brief history of the movement, its theories, deductions and aims; and a criticism of the whole movement as being utterly unscientific, though it may or may not have a foundation in fact.

Necessarily in a small book such as this, many extracts have to be condensed, thereby lending themselves to misconception, but every effort has been made to present the arguments from an unbiased point of view. There are quotations from many writers who hold divergent views on this vexed subject, which make entertaining reading.

Freud's interpretation of dreams is severely and we think justly criticized, and Chapter II includes a verbatim quotation from Freud dealing with the symbols employed by him.

It is a book we commend to readers who are interested in the subject of Psycho-Analysis, and it presents many problems for consideration which are as yet unsolved, though this statement would be disallowed by those who are definitely for or against the subject. The book is written in simple language, unlike many books on the subject, which are written with a "luxuriant mass of verbiage, in which the psychologist delights," as Professor Barry of Melbourne University said in a letter to the *British Medical Journal*, December 9, 1922.

W. L. W.

MAN'S MENTAL EVOLUTION, PAST AND FUTURE. By Harry Campbell; M.D., F.R.C.P. Pp. v + 74. London: Baillière, Tindall and Cox. 1923. Price 3s. 6d.

A thoughtful, interesting book, which contains in its pages more attractive material to think over than many a ponderous tome. Dr. Campbell seeks to discover the factors that determined mental evolution, and how far these factors are still in operation; why the primates have reached a higher mental level than other mammals, and why among the primates man has outstripped all others in the mental race. "How came it," he asks, "that of several anthropoid species, one particular species shot ahead in mental development and trebled its brain mass, while the gorilla, the chimpanzee, and the orang have, during the long years of man's ascent from his anthropoid ancestor, remained upon the same rung of the mental ladder?"

When the environment of a species undergoes change, that species may become extinct if it does not adapt itself to the change; if, however, it does adapt itself, adaptive reactions are set on foot. Variations from type which help adaptation to new environment have "survival value," as they tend to secure the survival of the species. When the pre-human ape became a hunter, there was initiated a series of conditions that continued to place a survival value on enhanced intelligence, the three principal factors being the hunting career, polygamy and intertribal warfare. Intelligent hunting sharpened the wits of the pre-human, and the first employment

of a stone or branch as a hunting weapon was a momentous event in mental evolution, creating a new standard for successful struggle. Polygamy led to the male who combined physique with intelligence, i.e., the qualities of leadership, securing the most wives and leaving the best offspring, while intertribal warfare, in which enhanced intelligence gave victory, and defeat meant annihilation of the vanquished tribe, led to a steady mental ascent which kept up all tribes that were in touch with one another to much the same mental level.

Dr. Campbell discusses the problems of mental evolution, past and future, in an interesting and comprehensive essay. He admits there is one transcending problem in mental evolution, and that is "whether our brief career here is the beginning and end of us, or whether we are to live on for ever under other conditions. Here we seem to pass beyond the realm of the Knowable, and to stand at the gate of the Unknown and the Unknowable."

M. B. H. R.

PRINCIPLES OF OPHTHALMOSCOPY AND SKIASCOPY. By G. F. Alexander. London: J. and A. Churchill. 1923. Pp. viii + 72. Price 5s. net.

This book expounds and translates into mathematical language the optical principles underlying ophthalmoscopy, the refraction of the emmetropic and the ametropic eye, and the correction of errors of refraction.

It is a brilliant exposition of the subject, and is lucidly and concisely written, the whole subject is dealt with in seventy pages. It should be invaluable to ophthalmic students, especially to those preparing for the higher ophthalmic examinations. Although a knowledge of higher mathematics is not required for a study of this book, a student will not derive much benefit from it unless he possesses a certain amount of mental agility in dealing with sines, cosines, tangents, etc.

HIGH BLOOD PRESSURE. By J. F. Halls Dally. London: W. Heinemann. 1923. Pp. xii and 155. Price 10s. 6d.

This volume of Dr. Halls Dally's personal observations on blood-pressure will be welcomed by those who appreciate the importance of correct observation and interpretation in this important subject. The book contains very precise instructions in the methods of pressure observation and some useful hints on how to avoid errors. The latter chapters are devoted to a consideration of the management of high pressure in different pathological conditions. The section dealing with the different types of sphygmomanometer, good and bad, is particularly useful. While there is much in the book that will appeal only to the cardiologist, it contains a great deal of information of use to the service medical officer.

J. H. S.

THE HISTORY OF PHYSIOLOGY DURING THE XVI, XVII AND XVIII CENTURIES. By Sir Michael Foster. 8vo. Cambridge University Press. 1924. 15s.

Not only those of us who learnt our physiology from Foster's classic textbook, but those who did not will appreciate this reprint of certain lectures delivered by him in San Francisco in 1900. Like all his writings they are both scholarly and lucid. We, who are apt to take much for granted, need to remember that we are children of our fathers and that the greater part of ourselves has come down to us from the past. This truth is applicable to physiology, as well as to all fields of science, since what we know now is no new fountain gushing from the rock of the unknown as the result of our own intellects, but really a stream which flows by us and through us, fed by the far-off rivulets of long ago. In this spirit Foster traces the growth of physiological knowledge through the sixteenth, seventeenth and eighteenth centuries. He begins with Vesalius, and his revolt against the teachings of his master Sylvius, then develops the effect of the work of Harvey, followed by the physical interpretations put upon that work by Borelli. From this he passes in review the work of Malpighi and the newer conceptions which arose as to the nature of the glands and body tissues. After this came Van Helmont and the rise of chemical physiology, followed later by the work of Black, Priestley and Lavoisier, with the rise of our modern ideas of respiration, and that of Haller, Bell and Majendie, which prepared the way for all that we know now as to the nervous system.

It is a large canvas displayed to our eyes, and each part thereof means much labour and groping in the dark. There are patches which seem grotesque to us, but can we be sure that our own contributions to the picture will not seem equally grotesque to those who tell our story a hundred years to come? Read in this spirit this volume draws a lesson from the past, and teaches a lesson for both the present and the future. We commend it to be so read, for it is full of information not generally known.

R. H. FIRTH.

HUMAN PHYSIOLOGY: A PRACTICAL COURSE. By C. G. Douglas, C.M.G., D.M., F.R.S., and J. G. Priestley, M.C., D.M. Oxford: Clarendon Press. 1924. Pp. ix and 232. Price 12s. 6d. net.

This book comprises the practical course in human physiology for the final honour school of physiology in Oxford, and as such does not attempt to cover the whole field of practical physiology. The subjects with which it deals are discussed very fully. These are, respiration and the use of the Haldane gas analysis apparatus, total respiratory exchange and energy production, the blood, the gases of the blood, the circulation, the kidneys and X-ray examination and chemical analysis of the contents of the alimentary canal.

It is a clearly-written, useful textbook on a subject that is becoming more important in the detection of the earliest symptoms of disease.

M. B. H. R.

THE STUDENT'S HANDBOOK OF SURGICAL OPERATIONS. By Sir F. Treves, Bart., G.C.V.O., etc., and Jonathan Hutchinson, F.R.C.S. Cassell and Co., Ltd. 1924. Pp. xi and 552. Price 10s. 6d. net.

This is the fourth edition of a very useful handbook, which has been revised by the second of its authors. His aim has been to prevent any increase in its size, and he has succeeded in enlarging its contents—and increasing its utility—by including much new material at the expense of methods and technique that have become surgical back numbers. It is still a small and compact book that will be as much in demand as ever.

M. B. H. R.

A MANUAL OF PRACTICAL X-RAY WORK. By John Muir, B.Sc., M.B., Ch.B., Sir A. Reid and F. J. Harlow. London: William Heinemann, Ltd. 1924. Pp. x and 524. Price 31s. 6d.

"Since the first appearance of this book in 1908 radiology, as an auxiliary to medicine and surgery, has developed to a remarkable extent in many directions.

"The inclusion, by regulation of the General Medical Council, of radiology as a necessary subject in the curriculum of all medical students seeking a British qualification, gives that subject a definite status that it well merits, and the potential usefulness of this book as a students' textbook on the subject has been kept specially in view in determining its character and scope. Sufficient has also been included to furnish a comprehensive introduction to study for a radiological diploma, and to give practitioners and surgeons an intelligent conception of the possibilities and the *limitations* of radiological assistance."

The author's aim, in the production of the third edition of this book has been so entirely successful that the publication is virtually a new one.

From a *military medical radiological* standpoint the book is especially interesting on account of the author's close connexion with the X-ray work at the War Office during the late war. In any subsequent reprint or edition the numerous references to the War Office Committees on localization, protection, instructions, use of field service outfits, etc., might be brought up to date as many changes have taken in the M.M.R. since the late war. Under the section on protection the latest report December, 1923, of the X-ray and radium protection committee should replace the original one of 1921.

D. B. McG.

X-RAYS: THEIR ORIGIN, DOSAGE AND PRACTICAL APPLICATION. By W. E. Schall, B.Sc.Lond., F.Inst.P. Bristol: John Wright and Sons, Ltd. 1923. Pp. 119. Price 5s.

This book is especially written to explain the physical laws and the electrical constants necessary for a knowledge of radiography and dosage in X-ray therapy.

The name of "Schall" is well known to all whose work is connected with the production and application of X-rays, and the present work keeps up the high standard associated with this name.

The book is one of the best and most useful for anyone taking up the special study of X-ray therapy physics as it combines the most up-to-date theories and methods.

The section on dosage and measurement is very full and radiographic technique in diagnosis is given in a concise and helpful chapter. The final chapter on deep therapy contains valuable tables and the book for this section alone should be in every medical library. D. B. McG.

DISEASES OF THE SKIN. By R. W. MacKenna, M.A., M.D., B.Ch.Edin. London: Baillière, Tindall and Cox. Pp. x and 450. Price 21s. net.

This is an excellent textbook and should prove most useful to the medical officer, who is keen on dermatology. Chapter II, on the treatment and the examination of skin affections, is particularly good, and should serve to remind him of many points which are so easily forgotten when the cases of diseases of the skin are few and far between.

The appendix contains many useful prescriptions, and full and detailed instructions are given.

The chapter on syphilis is necessarily short, but it seems a pity that more space was not given to the description of the various types of primary sores.

In the preface the author says that due attention has been paid to most advances in dermatology, and this is so.

One whole chapter is devoted to focal infections, to sensitization to foreign proteins; and the description of anaphylaxis leaves the reader with a clearer idea of this strange phenomenon than many more voluminous contributions to the subject.

A useful feature is the provision of tables of the diagnostic points of the difference between the more important diseases which are liable to be confused with one another, and another good point is the illustration by charts of the areas of distribution of certain diseases, e.g., lichen planus, psoriasis, scabies, although these diagrams might have been included more usefully in Chapter II.

Most authors of medical textbooks display their unfamiliarity with the rules of zoological nomenclature as soon as they touch on any branch of parasitology.

The names in the chapter on diseases due to animal parasites indicate no departure from this general rule, and stand in urgent need of revision. The author obviously adopts the generally accepted opinion that the head and body louse of man are varieties of the same species, and the name of the latter parasite is correctly named *Pediculus humanus corporis*. A little further on, this insect is raised to specific rank as *P. corporis*. On page 180 it appears as *P. vestimentorum*—even if the body louse is a distinct species, its name could not possibly be *vestimentorum*. In several places the crab louse is referred to as *Pediculus pubis*, although Leach removed this species from the genus *Pediculus* over a hundred years ago.

From this the reader will anticipate that the name *Acarus scabiei*, which time cannot wither nor custom stale, will not be found missing. Nor is it.

This species was placed by old zoologists in the comprehensive genus *Acarus*, which in their opinion included all mites and ticks. From this it was removed to *Sarcoptes* by Latreille in 1806, but by careful copying from book to book the mortal *A. scabiei* would appear to have put on immortality.

Filaria sanguinis hominis nocturna is the only name given for the worm causing elephantiasis. Apart from other objections, the form of this name is absolutely inadmissible.

If the author fears that his readers will fail to recognize the correct names of common parasites—in itself an eloquent commentary on medical knowledge of zoological names—any additional designations considered necessary could be given as discarded synonyms, but not cited as if they were correct or alternative names.

A. scabiei and such-like unhappy ghosts survive only in the pages of medical textbooks.

Why stretch them out on the rack of this tough world longer? Let them pass to a quiet rest. They have *earned* it.

However, in spite of this fault in nomenclature, this is a very readable and well written book and can be confidently recommended to the medical officer keen on dermatology.

HEALTH PROBLEMS OF THE EMPIRE, PAST, PRESENT AND FUTURE. By Dr. Andrew Balfour and Dr. H. H. Scott. London: W. Collins and Co., Ltd. Pp. xxi + 413. Price 16s. net.

This book is one of the twelve volumes of "The British Empire; A Survey." The series is designed to provide a comprehensive survey of the history and development, life and activities, resources and potentialities, of the British Empire.

"Health Problems of the Empire" deals comprehensively in 389 pages with very important problems connected with the public health interests of the great Commonwealth. The first part of the book, entitled the evolution of a health conscience, consists of a historical survey of disease and the gradual development of health measures in the British Isles, the services, and in most of the overseas possessions. The second part is devoted to the discussion of some imperial diseases, which are ancylostomiasis, cholera, dysentery, enteric fever, influenza, malaria, plague, smallpox, tuberculosis and venereal diseases. The third part, "Some Imperial Burdens" deals with maternity and child welfare, alcoholism, the drug habit and the financial aspects of public health. "The Outlook" forms the last chapter of the book.

Such is the arrangement of a work which contains between its two covers a wide, accurate and unbiased appreciation of the health situation

in the Empire at the present day. There is, of necessity, a great deal of historical matter throughout the book, but as far as possible statistics have been avoided. The intention of the joint authors has been to evoke interest and stimulate research in the very vital questions of Empire public health. In this they have been remarkably successful.

An interesting chapter is that on the financial aspects of public health. Several examples are cited, such as the triumph of Gorgas at Panama, Kunhardt's estimate of the damage done by rats in India during the first twenty years of the present century—£828,000,000—and the saving of 120,000 dollars by an insurance company which succeeded in reducing the mortality of those insured by the company, through periodical medical examination. The Outlook is a chapter to which one is inclined to turn before going very far through the book, as it is one of the most interesting and perhaps the most important. The probable lines of advance are discussed, the joint authors pointing out that there is no hard and fast line between home hygiene and tropical hygiene, and that advance is dependent first on research and second on education. Some of the progressive measures advocated include the gradual development of the Ministry of Health into one of the greatest of State departments; the institution of hygiene museums, educative, attractive, stimulating, so that the visitor could learn from the exhibits what is the nature of his disease foes, and how these are to be combated; the provision of literature on health matters, as in the United States; and the freeing of research from the attacks made upon it by fanatics, cranks and busybodies. "It is absurd that persons of this kind should be permitted to interfere with the progress of the world."

The joint authors state that the book is not a scientific treatise. Herein, perhaps, lies its greatness, as two distinguished scientists have been big enough to write in simple, plain, language a book which will appeal alike to the medical man, the lay administrator and anyone interested in the public health of the Empire. One must remember that health in its wide aspect is an important prop of the Empire, and its failure has been in the past one of the destroying agents of nations formerly great and powerful. As is pointed out in the chapter on malaria, this disease alone has exercised devastating effects on peoples. Even now, there is need for enlightenment and instruction among the educated, as the potentialities of efficient disease prevention are not fully understood.

Such is this book, which is one of the first to demonstrate the important part that hygiene plays in the Empire. Let us hope that it will serve towards the better organization and co-ordination of the forces which combat disease, improving their efficiency and hitting power. "Health Problems of the Empire" helps forward the cause of improved hygiene in our great Commonwealth, and the joint authors are to be congratulated on the production of an extremely interesting and clearly written treatise.

M. B. H. R.

Notices.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc. He will also be glad to receive items of news and information regarding matters of interest to the Corps from the various garrisons, districts, and commands at home and abroad.

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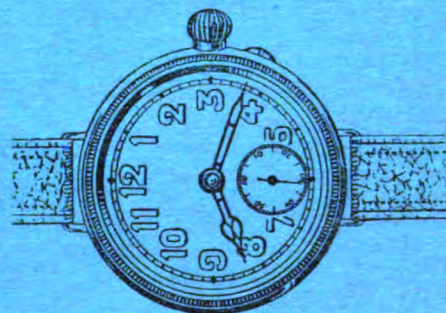
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THE WAR EFFICIENCY VALUE OF A WIDER OUTLOOK FOR
THE MEDICAL AND OTHER SERVICES OF THE ARMY.

BY MAJOR M. B. H. RITCHIE, D.S.O.
Royal Army Medical Corps.

FOREWORD.

My apology for writing an article which examines administrative questions is that certain disadvantages appear to exist in the system of dividing forces in the field into the two categories of fighting troops and services; and the British Army, progressive, striving after increased efficiency for war, is unlikely to refuse consideration of suggestions that might result in a further increase of efficiency. Also, as a member of one of these services—the Medical Service—I have endeavoured to demonstrate the difficulties of administering this service in the field, if the administration is to adhere strictly to the rules prescribed for it in Field Service Regulations. It is better to discuss these difficulties now, than to have regulations set aside in war as inoperative.

The criticisms are friendly and well-intentioned, made with the knowledge that better facilities for the study of war by the services, and the grant of more autonomy to the Medical Service, will increase the efficiency of the army, if it is called upon to take the field.

The profession of medicine in war is at present organized on the same lines as the profession of arms; without entering upon the *pros* and *cons* of this, it may be stated that the profession of medicine contains potentialities for securing military success in the field which are not yet fully appreciated. The doctor can assist the soldier to such an extent that the nation which exploits its medical service is the one most likely to win in a long drawn-out struggle, so long as the conservation of fighting-man power is necessary for

the attainment of victory. Should a new Napoleon arise, in the quest for undeveloped factors of success in war, he may turn to the doctor; some of his Marshals may be discovered, not in the pages of an army list, but in those of a medical directory.

FIGHTING TROOPS AND SERVICES.

Field Service Regulations, vol. i, 1923, lay down five general principles of war organization. These are Mobility; Unity of effort; Limitation of the number of subordinates with whom an authority has to deal; Central control combined with subdivision of labour and decentralization of responsibility; Economy of military force by utilizing the ordinary machinery of civil life to the greatest extent possible. The second principle is assured by vesting the supreme authority in one man, the Commander-in-Chief; the third by giving him three principal staff officers only, the Chief of the General Staff, the Adjutant General and the Quartermaster General.

The application of the fourth general principle leads to the division of military forces into two categories, the fighting troops and the services. Fighting troops consist of cavalry, engineers, artillery, infantry, pioneers, tank and armoured car units, and the Royal Air Force; they carry out the actual military operations and all their energies must be concentrated on that duty. Signal units, formerly a service and, in effect, still in the nature of a service, now find place among the fighting troops.

The services exist for the purpose of providing "the fighting troops with personnel, supplies, material and animals required," and consist of the Survey, Provost, Medical, Supply and Transport, Transportation, Postal, Ordnance, Veterinary and several other services.

The division of military forces into fighting troops and services has superseded the old distinction of combatant and non-combatant, now expunged from regulations but reposing almost snugly in the by-laws of a club. Members of the combatant category of former days were those exposed to the risk of becoming casualties from the offensive weapons of the enemy, while the non-combatants were not considered to be so exposed owing to the conditions under which war was then waged; but conditions have been so changed by the increased range of modern weapons, the advent of gas, and the influences of "frightfulness," that men in the forward area, whether belonging to a unit classified as "fighting troops" or merely a "service," are often exposed equally to the dangers of war, and casualties may be the heavier in a unit of the services. The fighter under fire has the natural consolation of hitting back at the enemy and giving as much as he gets; whereas the "service" man has to carry out his normal occupation—driving a lorry, for example—while someone, against whom he cannot retaliate, is attempting to take his life. In this way the courage demanded of the non-fighter may at times be of the higher order. The development of *moral* is as necessary for the "services" as for the fighting troops, owing to the new conditions of warfare; a lower physical standard is allowable in

the services, but any distinction between fighting troops and services cannot permit of a lessened *moral* in the latter class.

The services are controlled and co-ordinated by the A.G.'s and Q.M.G.'s staff. Officers serving on these staffs belong to the fighting troops. Officers of services do not pass from one service to another, nor do they become members of the A.G.'s or Q.M.G.'s staff, save in exceptional circumstances. While the services are in the nature of blind alleys, the staff is an open highway, and a staff officer may move from a high appointment on the general staff to another on the A.G.'s or Q.M.G.'s staff, or vice versa. The head of a service corresponds to a permanent Under Secretary of State, while a staff officer corresponds to the Cabinet Minister who may be Colonial Secretary one day and Minister of Pensions the next. The staff officer thus gains experience which is of high value to the army. The head of a service reaches his position by substantive promotion in his service; the staff officer usually ascends by brevet promotion, so that he may be controlling all the services of a formation at an age when he could not expect to be head of one.

War, to members of the fighting troops and services alike, is a subject that requires a great deal of study. Facilities for its study are, in a measure, limited and not available for all who should learn. In this respect the military profession differs from others; in law and medicine, for example, any man who feels inclined can obtain degrees or qualifications, provided that he possesses the brains to pass his examinations and the wherewithal to pay his fees. But the art of war is not taught outside the army, and the State, paying for the maintenance and education of an officer at the Staff College, has a right to decide who should be trained, and what the training will be. Hence the aspirant for the Staff College is selected under conditions that do not obtain in other professions; eligible between varying limits of age and service, he has to fulfil certain standards of proficiency, be physically fit and recommended as suitable, and though gaining high marks in the entrance examination, may fail to obtain admission, if others of his arm have passed higher and filled the vacancies allotted to that arm. Equally, he may obtain admission with comparatively low marks, if others of his arm have not gained more. If unsuccessful, but with qualifying marks, he may still obtain entry by nomination.

Though this would not suit another profession, there is much to be said in favour of the system. The State gets its staff officers from the different arms of the service in suitable proportions; entry by nomination recognizes the fact that a brilliant soldier may be overlooked, if judged entirely on the competitive examination standard. It is, however, a matter for consideration whether facilities for war study should not be granted to officers of the services as well as to those of the fighting troops. So much of war organization for the future is in the melting-pot that the non-diffusion of war study in the services is a loss to the State, leading to good military and administrative ability being bottled up in services which

have no upward outlet to the higher ranks and appointments. Junior officers of the services are recruited from officers of good ability, attracted frequently by increased pay, or impelled by the powerful forces that are set in motion upon the solemnization of matrimony.

From the broad view-point of army administration, the classification of units into those that are fighting troops, and those fulfilling the functions of services for the fighting troops, is convenient, and simplifies organization ; but it is open to criticism for several reasons. It tends towards the creation of a fighting and a non-fighting caste among soldiers who will have to share almost equally the hardships and dangers of future warfare. Many of the fighting soldiers must necessarily be employed on duties that come within the definition of services, such as units carrying out special duties, and individuals employed on the work of a service within their own unit. Also, the personnel of many services are called upon in emergencies to fight, and are trained in peace to the use of arms. Thus the boundary line is nebulous, and alters if the military situation becomes more critical.

Another criticism, as already stated, is the tendency of this classification to limit military study among officers of the services at a period when military thought requires to be concentrated on the elucidation of problems connected with future warfare and the services are becoming of more importance in fighting value ; also, there is the point that the administrative staff controlling the services is deprived of "service" experience, so long as that staff is recruited almost wholly from officers of fighting troops.

Still another criticism is the divergence in function among the services ; there can be little in common between them in this respect. Compare, for example, the medical with the postal services—function, objective, rôle, scope, are entirely different, whereas among fighting troops proper there is similarity in function. In respect of the medical service, perhaps this divergence is most noticeable. *It seems next to impossible to reduce the medical and the other services of an army in the field to a common denominator.*

THE HIGHER ADMINISTRATION OF THE MEDICAL SERVICE.

Here are some extracts from Field Service Regulations, vol. i :—

"The Commander-in-Chief is not directly responsible for the technical and financial methods employed in providing for the requirements of his forces. The responsibility rests with the heads of services subject to the general policy communicated by the principal staff officers" (Section 40, 7).

"The Adjutant-General of the forces in the field is responsible . . . for all medical and sanitary arrangements" (Section 26, 1).

"*Medical.*—The D.G.M.S. is attached to the A.G.'s branch of the staff. His representatives with subordinate formations are the channel of communication between the A.G.'s branch and the medical units and services

with such formations, and will advise on all medical matters. The duties falling to the A.G.'s branch of the staff as regards medical matters will be those relating to the provision of specialized medical equipment, sanitation, invaliding, the personnel of the medical services and the interior economy of medical units. The tactical disposition of medical units during operations will be decided upon by the A.G.'s branch of the staff after consultation with the general staff. The D.G.M.S. will deal directly with the Q.M.G.'s branch of the staff on questions in connection with the siting and construction of hospitals, hospital trains and ships and dieting in hospitals" (Section 27, 8).

"The duties of the movement section (of the Q.M.G.'s Staff at G.H.Q.) include :—

"v. Selection, in conjunction with the maintenance section, and after consultation with the general staff on questions of tactical security, of sites for . . . hospitals and other installations with special reference to transport facilities" (Section 35, 5).

"The offices of heads of services will be located as directed from time to time by the principal staff officer concerned; the representation of a service at advanced G.H.Q. will also be decided by him" (Section 40, 4).

"The head of a service controls the arrangements for carrying out the duties of his service in accordance with the policy formulated by the principal staff officer concerned, whom he advises on all technical matters connected with his work" . . . (Section 40, 5).

"Subject to the policy and general control of the principal staff officer concerned, heads of services are responsible for the technical and financial methods employed in carrying out the work of their services." (Section 40, 7.)

"The matters with which the services are concerned are detailed below :—

"v. Medical service. Care of sick and wounded and their evacuation when necessary. Administration of all medical units and advice as to their siting. Provision of specialized medical stores and appliances. Recommendations regarding all precautionary or remedial, medical and sanitary measures conducive to the prevention and mitigation of disease and the preservation of the health of the troops" (Section 43, 5).

Within recent years, the higher organization of the army has undergone modification. In a former edition of F.S. regulations, services were designated administrative troops, heads of services being administrative commanders; at this time, the grouping of these troops or services under three principal staff officers was similar to what it now is. At an earlier period, prior to an imperial general staff conference held about five years before the outbreak of the war, the Principal Medical Officer was on the

staff of a force, being staff officer of the G.O.C. on all medical and sanitary matters, issuing the orders of the G.O.C. on these matters to subordinate commanders. The P.M.O. was thus co-equal with the A.G. and Q.M.G., the principle of limitation of subordinates not having then been adopted.

Under this system, which was retained in India, a P.M.O. when corresponding with a higher formation wrote in the name of the G.O.C. and signed correspondence "for G.O.C., —th Division." To subordinate formations, as, for example, when issuing orders for the transfer of a medical officer from one formation to another, he wrote to the G.O.C. of the formation concerned, signing himself P.M.O. He was empowered to act thus, as he was one of the staff officers of the G.O.C., to whom he had the right of access and to whom he submitted all matters of importance.

The result of the imperial general staff conference referred to above was to limit the term "staff" to the general staff, the A.G.'s staff, the Q.M.G.'s staff and the personal staff; in this new system the P.M.O. became an administrative commander under the A.G., and ceased to be a staff officer. A distinctive uniform for staff officers was authorized at the same time.

The head of the medical service is no longer empowered to issue orders as described above; the procedure is to submit a draft order to the A.G.'s branch of the staff. If concurred in, the order is then issued under the authority of the A.G. or his representative. In the case of an A.D.M.S. of a division, this officer commands the R.A.M.C. of the division, and can therefore transfer officers from one medical unit to another within his division, or take action of a similar nature, on his own authority.

Grouped with the other services of an army, the medical service differs in most respects from its fellows. The number of troops to be placed in the field may depend on the figure that the supply and ordnance services can maintain; an army cannot take the field until sufficient supplies of food and ammunition have been collected. The casualties of war cannot be so controlled, nor can they be accurately foretold. The medical service in war has sudden demands made upon it, such as a large number of casualties, from battle or disease, occurring in a small area in a short space of time, with which it cannot decline to grapple however unexpected or underestimated these demands may be, and its flexibility and powers of expansion are in constant danger of being over-taxed.

Another point, never fully appreciated, is that *the medical service does not take the field completely equipped for its task*. An infantry battalion or other unit has in its mobilization equipment most of the essentials required for a campaign, but a medical unit is constantly making fresh demands on other services for additional stores and transport. It is not necessary to go beyond the mobilized field ambulances of a division to find an instance of this. The equipment of these ambulances has to be supplemented by hundreds of blankets and stretchers, obtained from the ordnance service, and their transport requires the addition of lorries or buses from the supply

and transport service, before the field ambulances are in a position to cope with the casualties after a general engagement with the enemy. No medical unit can combine mobility with adequate provision for a large number of casualties. It can aim only at catering for a limited number, but when that number is exceeded it cannot refuse to receive more; it must therefore be reinforced quickly, in order that it may expand sufficiently to deal with the emergency. Thus, other services are finite, while the medical service is infinite; *in the profession of medicine, war or peace, administrative or executive, bed-side or battlefield, the abnormal is the rule and the normal is the exception.*

The first two principles of war organization, mobility and unity of effort, do not apply to the medical service. The former is essential to this service, both for evacuation of casualties and for establishing medical institutions in the vicinity of the battlefield. But the ambulance transport permanently allotted to the medical service is insufficient for the task and has to be supplemented; casualty clearing stations, the most important medical units in the forward area, have no transport for moving forward in an advance, or rearward in a retirement; they are dependant for transport on the Q.M.G. Thus it can be contended that the medical service is not "organized primarily for a war of movement" (F.S.Reg., Sec. 2, 2).

The second principle, unity of effort, obtained by vesting the supreme authority in one man, is not established in the case of the medical service. The head of that service is not supreme, nor is the A.G., as he himself is not in a position to provide additional equipment or transport, these vital essentials being in the hands of the Q.M.G., who is not under the jurisdiction of the A.G., but co-equal with him. Supply, transport, ordnance and works are four services upon which the medical branch relies for the provision of food and medical comforts, means of evacuating casualties, tentage and hospital equipment, and hospital buildings respectively; none of these is under the charge of the principal staff officer of the Commander-in-Chief who is concerned with the working and administration of the medical service. Instead of unity of effort, the control of the medical service is distributed between the head of the service, the A.G. and the Q.M.G.

PSYCHOLOGY AND EFFICIENCY.

The human or psychological side of efficiency, and of sound administration, finds expression in the phrase, "I must have things in my own hands and run my own show." The doctrine contained in this is recognized by everyone in war, but is perhaps given too little prominence in regulations. If, for instance, a motor ambulance convoy belonged to a service other than the medical service, its efficiency value to the army would fall by about 25 per cent. The same in every branch, with every other unit—undetermined psychological influences begin to work, and matters, once simple, become difficult.

In the case of the provision of medical stores and equipment required in a sudden emergency, the head of the medical service can reinforce a medical unit with material from distant base medical store depots in a short space of time and with a complete absence of red tape, because these depots are under his control. With hospital requisites supplied by other services, when demands have to pass to these services *via* the A.G. and Q.M.G., giving reasons for the additional demands, delay and difficulty are inevitable. In war, "it never rains but it pours," and urgent medical requests for additional stores and transport probably coincide with urgent military demands, the medical service taking its turn with the others.

Medical breakdowns are due to lack of personnel, of hospital equipment, or of ambulance transport. Personnel can be concentrated rapidly, however complicated the machinery of concentration may be; but hospital equipment in the British Army is stored by the ordnance service, and consists largely of material issued also to all troops. (Medical store depots contain drugs, dressings, surgical appliances and instruments, etc., and are not concerned in the provision of hospital stores such as beds or bedding, tentage and furniture.) With additional equipment, as with transport, the undetermined psychological influences have to be overcome.

Herein lies the difficulty of operating the medical service in war; individuals vary in their capacity for obtaining help from others—one man may succeed in inducing others to help him where most of his fellows would fail. The "good beggar" faculty is a supreme accomplishment for the head of a medical service in war. *The complicated machinery of administration is best kept in motion by the mystic force of Personality.*

The point at issue is whether the army would benefit if more autonomy were extended to the medical service—is the existing system of administration, judged from every point of view, the best that can be devised, or is the army and the nation failing to obtain full value from the expensive medical service with which it is provided?

The application of the science of medicine to the art of war has only just begun; its potentialities are not yet recognized. Though one of the oldest services of an army, in its new sphere it is one of the youngest that is not yet merging into manhood. Forces can wage war in theatres where disaster formerly overtook them; now, they can enter and quit with impunity, *but it is the doctor who carries the key in his pocket.* A recent writer¹ pointed out that the military history of Palestine was one succession of disasters, from early times down to the failure of Bonaparte. This is a good example of the influence of medicine on war—it is not too much to assume that the discoveries of medicine, and the application of these discoveries to war, enabled Allenby's campaign in Palestine to be carried to a victorious conclusion.

The treatment of the sick and the prevention of disease, the two

¹ Major P. Manson-Bahr, D.S.O.

functions of the medical service, are both concerned in the matter, and early, efficient treatment of disease and wounds is as important in the conservation of man-power as hygiene. The existing system of administration is defective in several ways; it makes no provision for the right of direct access of the head of the medical service to the Commander-in-Chief; it places the head under a principal staff officer who is not in a position to provide the additional material required; responsibility is divided, machinery of operation complicated; and the psychological influences necessary for efficient administration are in abeyance.

THE ROUGH ROAD.

At the close of the Great War, the question arose whether the medical success was due to the system of army organization employed (similar to the present), or in spite of it. The general impression was that success came not from the system, but *in spite of it*. Daily, hourly, at division, corps, and other headquarters, the system was honoured in the breach. Co-operation with other branches (as opposed to obstructionism, that vice of war administration far more deadly than inefficiency) brought success. The pity is that expressions such as "being all out to help" and "working friendly-like" cannot be embodied in regulations with the honour due to them, as they represent the cardinal principles of efficient war administration.

However well governed and administered they may be, nations, communities, professions, are never happy without autonomy; there must be a large measure of self-government granted to them. This is what the medical service requires. But the grant of autonomy would be attended by greatly increased responsibilities and wholesale scrapping of systems and methods of operation; it has to be recognized that autonomy is no simple matter and leads to the abandonment of the smooth path of advisory administration, in favour of the rough road of full responsibility and executive function, carried out by a profession which, up to now, has been concerned principally with giving advice. (It is easier to be serf than chief, and it is difficult to become chief if most of a lifetime has been passed in serfdom.) Such is the perversity of human character that nations, communities and professions, given the opportunity, abandon the smooth path and take with contentment to the rough road. It is this rough road that the medical service wishes to traverse, not from any reasons connected with selfish motives, but because on the rough road it can be of more value to the British Army in war, and to the British soldier. It is not a matter of medical *amour propre*, but of military efficiency and success in war.

In the distant future, it is probable that the medical services of the Navy, Army, Air Force, and Indian Army will be united into one Imperial Medical Service. I do not intend to discuss the reasons for supposing that this fusion will eventually take place, nor its advantages and disadvantages. Meanwhile, let us hope that the administrative tendency will be towards an

increase of autonomy, such as authorizing the head of the medical service to have direct access to the Commander-in-Chief, and to act as his staff officer on medical and sanitary matters; whether allowed by F.S. regulations or not, in every formation it is the custom for the head of the medical service to possess this right of access. But these measures will not be attended with complete success if the control of material is not in the hands of the medical service, and this service is not vested with financial powers.

Without complete autonomy, however, much could be done towards making the machinery of operation less complicated. The medical service was placed originally under the A.G. because good sanitation was a matter of discipline, and the A.G. dealt with discipline; but in war, the service would be better placed under the Q.M.G., who is in a position to make it a success. Another suggestion is to expand the medical store depots so that they could take over in bulk from ordnance, reserves of hospital equipment likely to be required in emergencies. Also, transport for moving semi-mobile medical units like casualty clearing stations might be authorized. This would not be required for each unit; the suggestion in France was to allot twenty lorries to the Director of Medical Services of each army, for the purpose of moving his casualty clearing stations and evacuating lightly wounded cases.

Measures such as these would make for increased efficiency and smoothness of running; but there are other questions involved, one being the recruiting of medical officers. The writer holds the view that the attractiveness of a service may depend as much upon the scope it has to offer as upon the emoluments it is prepared to disburse, and it is possible that lack of autonomy militates against recruiting as much as lack of emoluments. The medical service of an army is essentially one for young, keen men; war and medicine are firmly united in a partnership that requires the presence of clever young medical officers; they will be wanted by the general staff in connection with the problems of possible theatres of war; by the Adjutant-General's staff, for recruiting and man-power problems; and by the Quartermaster-General's staff for dealing with the numerous problems connected with the hygiene of an army. The more they are employed on administrative work of this description the greater is the gain to the army. Increased medical efficiency means increased war efficiency.

In spite of the wide scope which the medical officer of the future may develop, the medical services of the State do not attract young medical men at the present time; much professional experience is available, surgery and tropical medicine, among other branches of professional study; a large scientific playground is to be found in the laboratories, and there is the pioneer work which lies before us in the development of the *liaison* between the profession of arms and that of medicine, involving the mobilization of every known medical principle and scientific discovery in order to overcome more effectively the enormous loss of man-power in war from battle and disease; yet—interesting occupation, agreeable environment,

opportunity to see the world notwithstanding—the young medical man prefers the more restricted life of civil practice.

Why is this? Is it because in the service he does not possess that autonomy, that essential factor for real efficiency, "running his own show," which he has in civil life? Many able young medical men are, comparatively speaking, sufficiently well off to ignore the difference between the emoluments of the services and those of civil practice; but they do not enter. Lack of autonomy, lack of influence in the general direction of army affairs, two characteristics of medical organization at the present day, militate against the recruiting of medical officers; a larger measure of both would bring in more recruits, and it would lead also to a higher standard of efficiency throughout the British Army when it is again engaged in war.

VENEREAL DISEASE AMONGST BRITISH TROOPS IN INDIA.

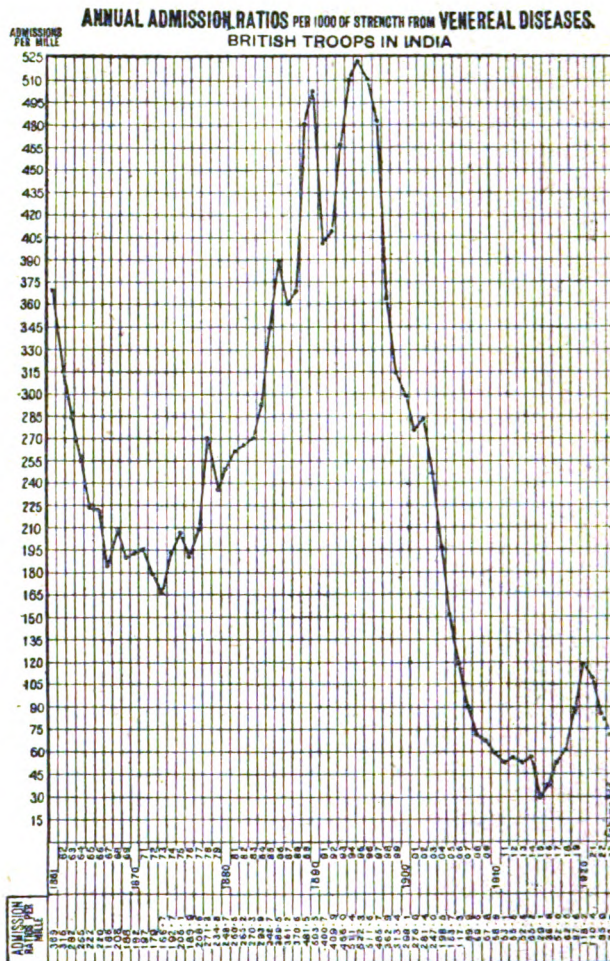
BY BREVET-COLONEL A. H. SAFFORD.

Royal Army Medical Corps.

Late Consulting Dermatologist in India.

I.—SHORT HISTORY.

CHART I shows at a glance the incidence of venereal diseases amongst British troops in India since 1861, and the references will enable those who are interested in studying the history to consult the authorities quoted.



The first attempt to control venereal disease of which we have record was in 1864, when the Rules for Lock Hospitals were framed; these were eventually introduced in 1866 (*vide* Reference 3). Two years later in

1868 the Contagious Diseases Act was introduced which aimed at the control of prostitutes and brothels.

These efforts appear to have met with considerable success, as between 1861 and 1873 the ratio per 1,000 of strength fell from 369 to 166.

In 1870 the short service system was introduced, and had an adverse effect, the reason being probably the increased turnover of material, i.e., the number of new young soldiers being drafted into the country. In 1882 the married establishment was reduced; in 1872 the married establishment was:—

Staff-Serjeants and Serjeants	...	...	...	All
Trumpeters, Drummers, and Rank and File	...	...	...	12 per cent
but in 1882 this was reduced to:—				
Warrant Officers and N.C.Os. (Classes 1, 2, 3)	...	...	...	All
Classes 4 and 5—				
Cavalry	...	...	...	6 per cent
Artillery	...	...	...	8 „
	for next five years, and then	...	...	6 „
Infantry	...	...	...	4 „

This led to a very rapid rise in the venereal rate until it reached 389·5 per 1,000 in 1886. The causes which were considered to have led to this increase are detailed in the Sanitary Commissioner's Report of 1885 (published in 1887). The most interesting note is: "In 1885 married men showed three admissions per 10,000 less than in 1874, and unmarried men 118 per 10,000 more than in 1872"; showing that the reduction of the married establishment had a very marked adverse effect.

Between 1887 and 1890 questions were raised in Parliament regarding the registration and recognition of prostitutes, which led to the Cantonment Act and the establishment of cantonment hospitals in 1890, when the venereal rate had risen to 503·5 per 1,000. These measures appeared to have a beneficial effect, as the rate dropped to 400·7 in 1891, but again rose during the following years until it reached the record figure of 522·3 in 1895. In the same year Act V was passed which practically swept away all regulations regarding the control of prostitution. The following year cantonment hospitals were replaced by followers hospitals and dispensaries, but were re-established in 1899 with consequent control of prostitutes under the Cantonment Act.

From 1899 onward until the outbreak of the Great War there was a very rapid decrease in the incidence of venereal diseases. During this time much greater interest was taken in the welfare of the soldier—the institutes were improved, encouragement was given to sport, trade, and craftsmanship, education was improved, and instruction given in the prevention of disease. These measures, together with the supervision of prostitutes, had the desired effect, and the venereal rate was reduced from 522·3 per 1,000 in 1895 to 29·1 per 1,000 in 1915—a very remarkable achievement.

Unfortunately this improvement was not maintained, and with the outbreak of war the incidence began to rise.

In 1918 the power to close brothels under the Defence of India Rules 1915 was put into force, and no brothels were allowed to exist in cantonments or places where troops were assembled. This measure entirely failed to attain the desired object, and six months after the termination of the war the Defence of India Act, under which these rules were framed, became inoperative with the result that a steady improvement has taken place.

Although properly conducted brothels may now exist in cantonments, they in no way receive official recognition, and periodical examination of women is prohibited.

The above brief résumé of the legal enactments for the control of venereal diseases indicates clearly that a decrease in the incidence of venereal diseases has invariably followed measures which have been adopted for the supervision and control of prostitution. This important point will be referred to later when considering the measures which are required for the prevention of the diseases.

II.—THE INCIDENCE OF DISEASES AMONGST BRITISH TROOPS IN INDIA.

A reference to the chart shows that there was a rapid rise in the incidence of disease after the outbreak of war, or rather after 1915. The ratio per thousand of strength during the last ten years has been :—

1914	...	...	...	55·2
1915	...	...	...	29·1
1916	...	...	...	36·8
1917	...	...	...	52·0
1918	...	...	...	62·5
1919	...	...	...	87·6
1920	...	...	...	118·2
1921	...	...	...	110·4
1922	...	...	...	84·7
1923	...	...	...	72·0 (Estimated.)

The ratio in 1915 was the lowest on record, and was, no doubt, mainly attributable to the anxiety of the troops then serving in India for active service. It was well known that a man with venereal disease would not be sent on active service. Another factor which had a considerable effect was that the Regular troops were being relieved by Territorials who were of a somewhat higher social scale and had a large proportion of married men; that these two advantages were soon counterbalanced by the unsteady effect of war and environment was soon demonstrated.

The closure of brothels in cantonments had a very adverse effect, as was only to be expected; the result was that all diseased prostitutes were turned out of the brothels to seek their living on the roadside on the

borders of cantonments; whilst those not so diseased found a ready employment in brothels kept for natives, so that the British soldier suffered and the native benefited.

This state of affairs still existed when I took over the duties of consulting dermatologist on April 1, 1921. The monthly ratio per 1,000 of strength was 10·8, and was rising. Early treatment rooms were just being taken into use, but the majority were very crude, and being poorly equipped and badly managed they were, in my opinion, doing more harm than good. Judging by the returns for the first half-year it was estimated that the rate for 1921 would be 124 per 1,000. That this figure was not reached, the figure actually dropped to 110·4, was undoubtedly due to the interest taken by commanding officers in the subject and the provision of prophylactic measures. Although this reduction is satisfactory, it is not sufficient, and if the necessary measures are adopted I believe it can be reduced to below the pre-war figure in a short time. Even under the present half-hearted measures the monthly rate fell to 4·9 in October, 1923.

The highest rate is in the seaport towns—Bombay, Calcutta, Rangoon, Madras, and Karachi. The main reasons for this are the situation of the barracks in large towns surrounded by native dwellings with easy accessibility to the barracks (except in the case of Calcutta and Madras), the large number of places of entertainment such as cinemas where Eurasian prostitutes resort, and the European brothels where the scum of European prostitutes are collected. It is perhaps something in their favour that the majority of men prefer to "go with a white woman," but unfortunately she is often the most dangerous.

In some towns, Rangoon, Karachi and Quetta, early treatment rooms have been established in the part of the town most frequented by the soldiers, and have had a most beneficial effect.

III.—THE ORGANIZATION OF CONTROL.

(a) Medical.

(b) Regimental or unit.

The medical control consists of:—

(1) The consulting dermatologist at Army headquarters.

(2) The specialists in dermatology, one to each district.

(3) The officer in charge of the Central Dermatological Laboratory, located at Poona.

(4) The medical officer in medical charge of each unit.

(1) *The duties of the consulting dermatologist are:—*

(a) To supervise and co-ordinate the work of all specialists and the work in the Central Dermatological Laboratory, and to inspect the venereal sections of all British and Indian station hospitals in India, Burma and Aden; and advise on the treatment of cases and ensure that all technical equipment is correct and up-to-date, and investigate and consult with the local military authorities regarding general procedure for prevention of disease.

(b) To lecture periodically to all British units throughout India, Burma and Aden.

(c) To inspect all early treatment rooms of British and Indian units, and advise commanding officers on the procedure and system necessary to make these rooms effective.

(d) To collect and consolidate all statistics regarding venereal disease of the British and Indian Armies in India; and investigate immediately the factors causing exceptional or abnormal monthly incidence at any particular place.

(e) To investigate cases of poisoning and deaths, and all cases of intolerance to the drugs in common use.

(f) To prepare pamphlets and instructions for circulation to all specialists on the latest methods of treatment, equipment, scientific methods of diagnosis, laboratory investigations and means of prevention.

(g) To supervise the training of special treatment orderlies and the instruction of junior R.A.M.C. and I.M.S. officers.

(h) To prepare the annual venereal report for submission to the Secretary of State, and the section on venereal diseases of the Sanitary Commissioner's Report, and the Army Medical Report.

To give some idea of what the above duties entail it may be of interest to state that during the 2½ years (April, 1921 to December, 1923) I held the appointment I travelled over 52,000 miles and delivered 120 lectures to the troops.

The pay of the appointment is, for an officer of over twenty-five years service, Rs. 2,400 per month; for an officer under twenty-five years' service, Rs. 2,200 per month. If held by a major it carries the local rank of lieutenant-colonel; an officer holding the appointment is graded as an A.D.M.S.

The case cards of both British and Indian troops are disposed of in the office of the consulting dermatologist, over 12,000 cards are dealt with annually.

Graphs showing the ratio per 1,000 of strength of fresh and relapse cases are maintained for each district monthly, and a record of the actual admissions in each station is kept separately.

(2) *The duties of specialists in dermatology are :—*

(a) The medical charge of the venereal section of the British station hospital at the station of the headquarters of the district.

(b) To visit periodically the venereal wards of each station hospital (British and Indian) in the district, and to supervise the treatment of venereal diseases in each.

(c) To obtain each month from the office of the A.D.M.S. the statistics of venereal disease of each station in the district, and investigate and report on the causes of any marked increase of disease.

(d) To arrange for the instruction and training of N.C.O.s and men of the R.A.M.C. as special treatment orderlies.

(e) As facilities occur to arrange post graduate lectures for officers of the R.A.M.C. and I.M.S. on recent advances in the principles of diagnosis and treatment.

(f) To advise officers commanding units on the organization and equipment of early treatment rooms and on all points in connexion with the prevention of venereal diseases.

It is very necessary that each specialist should keep in close touch with the consulting dermatologist. This need not always be done through official channels, in fact, it is much better done by an occasional D.O. or private letter. In a huge country like India the local conditions vary considerably in each station, and unless the consulting dermatologist is kept fully informed of these conditions it is impossible for him to appreciate the difficulties which arise or the causes of a decrease or increase in the incidence of disease in any particular district or station.

Duly qualified specialists receive an allowance of Rs. 75 per month, in addition to the pay of their rank.

Specialists are available for any other duty in the station, but to carry out their duties efficiently it is most desirable that, except for their tour of duty as orderly officer, they should be only employed in their own particular work. They are seldom moved from the station to which they are originally posted.

(3) *The duties of the officer in charge of the Central Dermatologist Laboratory, Poona, are:—*

(a) To test all sera sent by British and Indian station hospitals for the Wassermann reaction. Over 20,000 tests are carried out yearly.

(b) To make microscopical examination of specimens for the *S. pallida* or other organisms.

(c) To make pathological examinations in connexion with venereal disease.

(d) To instruct in laboratory work newly joined officers of the R.A.M.C. and I.M.S. and to arrange classes of instruction for civilian practitioners.

(e) To carry out research work in connexion with venereal or skin diseases.

Owing to the large number of sera dealt with the work in this laboratory is heavy and somewhat monotonous; but the officer is somewhat compensated by having a permanent appointment situated in a good station and a well equipped laboratory.

The officer in charge of the laboratory receives an allowance of Rs. 100 per month, in addition to the pay of his rank.

If considered necessary by the officer dispatching the serum the result of the test is sent by telegram, so as to save delay in commencing treatment.

Many medical officers do not appear to realize that when a serum is returned as "septic" that this is not the fault of the laboratory, but is a reflection on their own technical skill when taking the serum.

It has been frequently suggested that the tests for the Wassermann reaction should not be centralized in one laboratory, but should be carried out in district or brigade laboratories. Apart from the increased expense that would be involved I am strongly against this suggestion, and consider it essential (anyhow until the test becomes simplified) that the tests should be carried out in one laboratory where a large number are done daily, and the personal error is reduced to a minimum.

(4) *The medical officer in charge of units.*

It hardly appears necessary to detail the duties of the medical officer, but a few points may be of use to junior officers of the corps.

To carry out his duties successfully the first essential is that the medical officer should be on the best of terms with the officers of the unit and especially with the commanding officer. He should keep the commanding officer fully informed as to the sick state of the unit, and make practical recommendations for its reduction. He should never make any recommendation that is not practical and which he is not prepared to prove can be carried out. Advice should be given and recommendations made by a personal interview with the commanding officer, and correspondence and reports avoided. By being keen himself he will very soon stimulate keenness in others.

Every N.C.O. and man in the unit should be known to him personally. This is often difficult in a large unit such as a regiment until he has been with them for some considerable time, but it is the object to be aimed at.

Periodical medical inspections of the whole unit, and of all drafts and men returning from leave should be made.

Each case of venereal disease should be fully investigated and an endeavour made to trace the source of infection.

He should frequently visit the early treatment room and advise the commanding officer regarding its management and equipment. It is *not* the duty of the medical officer to equip the room or to try to run it himself. He should keep in touch with the officer in charge of the venereal ward so as to be able to keep the commanding officer informed of the progress of the cases, and when they are likely to be discharged from hospital.

(b) *Regimental or unit control.*

The unit control consists of :—

- (1) The officer commanding.
- (2) The company, platoon, squadron or section commanders.
- (3) The sergeant-major and N.C.O.s.
- (4) The provost sergeant.

(1) and (2) The commanding officer of a unit is responsible for all that goes on in the unit, and for the health of the men under his command. By strict discipline, taking an interest in the welfare of his men, encouraging sport and entertainments, and by stimulating a spirit of *esprit de corps* in the unit he can do an enormous amount to reduce and control the incidence of venereal disease. His subordinate commanders, by taking an

equal interest and encouraging *esprit de corps* can help to control the venereal rate.

It is often noticed that the court martial rate and the venereal rate in a unit go hand in hand.

(3) What has been said regarding the officers applies equally to the sergeant-major and N.C.O.s, but they can undoubtedly exercise a much greater direct influence. I often tell them that when any man goes into hospital with venereal disease they should visit him in hospital, and try to find out where he contracted the disease, then when the man rejoins from hospital they should make him understand that he can "make good" if he chooses; and if he is a decent fellow he will do his best to do so. The man who is frequently in hospital with venereal disease should be made to understand that he is no good to them.

(4) The Provost Sergeant.—This N.C.O. can often do more good than any other. If he is carrying out his duties properly and has the police under him in proper control, he very soon knows where the men go for women, who are regular offenders, and from which women men contract disease.

It does not appear to be generally known that the power to examine or expel from cantonments women who are suspected of being infected still exists under the Cantonment Act and should be enforced. The periodical examination of women is prohibited.

IV.—PREVENTION.

For the sake of brevity and to save repetition I will not discuss in detail the various measures in connexion with discipline, education, improved conditions of the soldier, etc., which are in vogue as means of prevention, but will mention later how I think they can be still further improved.

The medical prophylactic measures are :—

(1) Early treatment rooms in the lines of each unit.

(2) The provision of prophylactic "outfits" on sale to the men by the attendant in charge of the early treatment room or the company storeman. These packets are sold for four annas each. They are *not* provided free for the following reasons :—

(a) It is unlikely that the Government of India would sanction the expenditure, even if they were asked to do so, which has not been done.

(b) It is not considered desirable to supply them indiscriminately, as then they come into the possession of young soldiers who may be tempted into vice purely out of curiosity.

(c) If a man buys one he does so deliberately and with full intention of using it.

(d) If a man can afford to pay several rupees to go with a prostitute he can well afford to pay four annas for a packet and so try to protect himself against disease. If he does not do so he is, in my opinion, not worth

protecting. Except against syphilis I am very doubtful of the efficacy of these packets and prefer to rely more on the use of the early treatment room.

That these measures are of considerable use, but are not sufficient, is proved by the results, so I will now detail the measures I consider necessary to reduce the incidence of venereal disease to a minimum.

Measures necessary to reduce venereal diseases in India. These are dependent, to a great extent, on policy; and it is not considered politic by the authorities to introduce the measures I am about to advocate.

To my mind the time is now passed for us to act the part of the ostrich and hide our heads in the sand. We must recognize the fact that immorality exists and will exist until the social and religious education of the community has been brought to a state of perfection that immorality will not be tolerated. Having accepted this, then we must not confine our energies to dealing only with one half of the problem, as is being done at present, i.e., protecting the male community, but must attack the whole question fearlessly and legislate for dealing with the women.

One has only to study the history of venereal disease in India and the various measures which have been taken from time to time in an endeavour to control the disease, to find that the measures which have met with the greatest success have been those which aimed at the control of prostitution.

The following are the measures which I consider necessary:—

(1) The recognition and control of brothels. The main advantages are:—

- (a) The area of prostitution is limited.
- (b) The number can be limited.
- (c) Regular examination of the women can be carried out, and diseased ones excluded.
- (d) Foci of infection can be traced and eliminated.
- (e) Clandestine prostitution would diminish.
- (f) The women themselves are under better living conditions and able to maintain cleanliness and to prevent disease in themselves.
- (g) Early treatment can be provided in the brothel, so that no time is wasted.

I do not for one moment suggest that infection would never occur in a recognized brothel, as medical men well know the extreme difficulty of detecting venereal diseases in women, but it stands to reason the chances of infection would be enormously decreased.

The abolition of "blue lamp" rooms in Germany was invariably followed by an increase of clandestine prostitution. In Paris in 1917 only 5 cases of venereal disease were traced to licensed houses, whereas out of 100 women detained from the streets on one night, 91 were found infected, and on another occasion out of 71 women examined 55 were found infected.

(2) The use of the early treatment room of the unit by all men who have exposed themselves to infection must be made compulsory, and

neglect of this precaution made punishable. Men who use the room, and can prove they have done so, would receive no punishment and would only forfeit hospital stoppages and loss of proficiency pay during the time they are in hospital. The legality of such an order is beyond question. In order to prevent malaria a commanding officer issues an order that all men must let down their mosquito nets at night, and disciplinary action is taken against any man disobeying this order. A man who indulges in promiscuous intercourse is *deliberately* exposing himself to disease, and I consider that if he fails to utilize the prophylactic measures provided, he should be punished in the same way as the man who fails to obey the order regarding the mosquito net.

The principle involved is analogous to that of prevention of "trench foot" in France when prophylactic measures were advised by the medical authorities, but it was not until the strictest disciplinary action was enforced, that the disease was controlled and almost eradicated.

Owing to the lack of uniformity in the methods adopted in India, some units keep a record of attendances, whilst others do not, it is impossible to quote figures in support of the effectiveness of early treatment rooms, but in one unit recently visited where records of attendances were kept I found that the average number using the room was 80 per month and only one case of venereal disease had occurred in 10 months.

It is not claimed that the prophylactic treatment is as efficacious against gonorrhœa as against syphilis; this is shown by comparing the admissions for 1921 and 1922. The reduction was:—

Syphilis	...	...	...	31 per cent.
Soft sore	...	...	...	24 „
Gonorrhœa	...	...	...	15 „

There are no doubt just as many women infected with syphilis as before; a man cannot chose whether he is going with a woman infected with syphilis or with one infected with gonorrhœa; therefore the only way that one can account for this very marked reduction is by the prophylactic measures adopted.

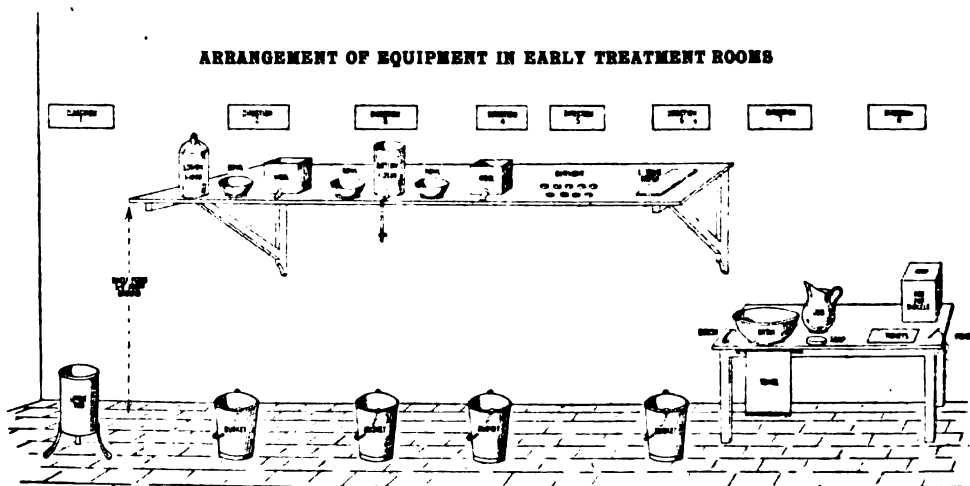
The number of admissions to hospital during 1922 was 5,099 for all forms of venereal diseases, as against 6,479 in 1921. The average duration in hospital was 44 days, making a total of 224,356 working days lost during the year, and is practically equivalent to the loss of a whole battalion of infantry.

I am convinced that until the strictest disciplinary action is taken to enforce the prophylactic measures devised by the medical authorities, little further improvement is likely to accrue.

(3) Improved conditions for the comfort of the troops. Although a certain amount has been done during the last few years to improve the conditions of life for the soldier, there is still considerable room for improvement.

Many barrack rooms in India are still lit by an oil lamp only one wick of which can be lighted, owing to the small allowance of oil, and by which it is impossible to read a home letter, and even if recourse be made to the regimental institute the conditions are very little, if any, better. The provision of comfortable and well-lighted barrack and recreation rooms will do more to keep men in barracks and away from temptation than anything else.

Lord Roberts' idea of making the canteen as unattractive as possible was undoubtedly a mistake. What is required is a club for the soldier where a man can either drink beer or coffee, served in the same room; the clerical element of control should be eliminated. Major-General Sir H. C. Uniacke has started an excellent club in the Muree Hills, and Major-General Holman has converted his own house into a soldiers club at



Karachi; so by individual effort a little is being done; but what are one or two stations in the whole of India?

The methods of preparation and service of food in barracks are also most unsatisfactory and in very few are dining rooms provided. To my mind it is marvellous how the sick rate has been reduced in India by sanitation and inoculation *in spite* of little or no improvement in the feeding arrangements.

There are many other measures that might be advocated, such as increased powers to deal with procurers, pimps, etc., but if only the three measures mentioned above were taken in hand at once and thoroughly carried out I am convinced that there would be an immediate and marked improvement.

I should like to take this opportunity of thanking the many officers of the corps who have extended to me the greatest help, kindness and hospitality during my tours of inspection in India.

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- [9] 1887. Ratio 361·2 per 1,000. The Lock Hospitals mentioned under Reference 8 above were re-opened. Sanitary Commissioner's Report, 1887.
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1896. Percentage of married men to strength, 1872-73, 11·19; 1892-93, 3·29.
Venereal Disease ratio per 1,000 of strength, 1872-73, 166·7; 1892-93, 409·9.
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- [18] 1907. Indian Army Order D/22/2/07. C.-in-C's (Lord Kitchener) gratification at reduction of rate of 281·4 in 1902 to 118·0 in 1906.
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C.-in-C. directed that this rule was to be generally applied. (No. 04745-1 (A.G. 5) D/2/8/18.)
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SOME NOTES ON RECRUITS AND RECRUITING.

BY CAPTAIN R. A. MANSELL, M.B.E.
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THE collection of consecutive data, and the reduction of them to something like intelligible form, is a lengthy and tedious process, and I want to admit, straight away, that the numbers dealt with here are really quite insufficient for the formation of any dogmas on the subject, and therefore anything in these notes which may appear as a definite statement should probably only be taken as the basis of possible future discussion or disproof. If, however, the collection of notes on the development of soldiers, either as recruits or as fully trained men, is in any way stimulated, and their publication in a form easily available to all members of the Corps hereby encouraged, there will at least be some data gained. I have been surprised at the small quantity of literature which appears to be available to help the medical officer who comes fresh to the selection and care of the recruit. It is not until one has been able to watch a series of squads of recruits growing before one's eyes, and has devoted some considerable time to the consideration of recruits in the abnormal conditions of their first few months of Army life and training, that one grasps the enormity of the subject. The further one proceeds the more the varied sides of the matter present themselves; consequently the insufficiency and incompleteness of these notes are but evidence of a growing appreciation of the possible value of certain investigations and statistics, and are due rather to limitation of time than to lack of material. As the data have been collected in the midst of ordinary routine work, experts on the subject—and others too—will recognize that there is here more of the search for knowledge than of the profession thereof.

The standards to be observed in passing men into the Army are very clearly laid down in Regulations, and whilst it would appear that but few and unimportant discrepancies could creep into the anthropometric details of any given individual dealt with according to the recognized rules, we all of us know how many pitfalls and traps there are for the medical officer who is not meticulously careful all the time and every time, and how particularly easy it is to fall into one of these, more especially if a too willing recruiting staff is allowed to assist with the scales or tape. Too much stress cannot be laid on the value of the old saying that if you want a thing well done you must do it yourself.

I suppose that about a quarter of an hour is devoted to the first medical examination of the average recruit before he is passed as fit; he is re-examined when he joins his depot, a little more rapidly probably. Even so, the time is really all on the short side in most cases for making a

decision as to whether a man is really fit for the strange and strenuous life which he proposes to enter. The question presents itself whether or not we can find any aids outside the regulations to help us to decide whether any given individual is likely to make an efficient soldier; in short, whether we cannot, with as little extra worry as possible, reduce the very expensive wastage which goes on at present at most regimental depots in the way of men turned out during the course of their training, without materially interfering with the regular and adequate supply of recruits.

Some idea of the bore of the waste pipe which carries off the unsuitable and the unfit from the depots back to the streets and unemployment whence most of them came, may be gathered from the fact that, at the most, only about sixty or seventy per cent of any given squad of recruits joining can at present be expected to survive the five months' training which they have to undergo, and this in spite of the fact that they have all of them been passed by at least two medical officers, a recruiting officer and an officer commanding a depot; one way or another nearly a third of them will fail during the course of their training. This wastage is the cause of considerable financial loss, and I doubt much whether the money so wasted produces any return at all.

Table I shows (from my own experience, as are all the figures in these notes) to some degree the care with which the men are sorted out in the first instance; and, too, gives some idea of the extent to which we are suffering physically as a nation from the period of the Great War, when parental and Governmental discipline of the home and school life of the soldier-providing classes was somewhat more lax than it normally is. The figures in column 4 of this table show an increase compared with the year 1912-13 of twenty-seven per cent, and with the year 1920-21 of thirteen per cent (*vide* JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, Vol. XLII, p. 190. Address by Major-General W. W. O. Beveridge, C.B., C.B.E., D.S.O., K.H.S.). They relate, however, to only a very small part of the Army, and the grand total may not be quite so depressing; in any case, this state of affairs should shortly right itself to some considerable extent. Other nations have suffered, and do suffer, from the same physical deterioration in similar circumstances. At the same time, it must be remembered that a higher standard of education is required from the present-day recruit than used to be the case, and that the effect of the unemployment dole on the physique of the soldier-providing classes has yet to be calculated.

TABLE I.

All applicants			Applicants seen by M.O.	
Rejected by Recruiting Staff	Rejected by M.O.	Passed	Rejected	Passed
24.2 per cent ..	34.7 per cent ..	41.1 per cent ..	48 per cent ..	52 per cent

Total numbers concerned = 327.

Another matter of interest which arises in this connexion is the extent to which the recruiting office staff reject or send up for examination

applicants for enlistment. A considerable proportion of "impossibles" and "undesirables" necessarily present themselves at all recruiting offices, but any medical officer who has worked with several recruiting staffs will have realized that the percentage of rejections which he has to make tends to differ according to whether or not the staff know his particular carefulness or fancies. For instance, for a short period I was detached from my own station to a larger recruiting office, and Table II gives a comparison of my experiences in this respect "at home" and "away." I leave the reader to draw his own conclusions, and do but repeat that the recruiting medical officer needs his wits about him all the time and every time.

TABLE II.

	Rejected by Office Staff	Rejected by M.O.	Passed	Total number
Home ..	26.85 per cent ..	25.98 per cent ..	47.24 per cent ..	127
Away ..	21.50 ,, ..	43.50 ,, ..	35.00 ,, ..	200

Of the measurable factors with which one has to deal, perhaps the most easily dismissible are those of visual acuity and dental efficiency; in the latter case there is now nearly always a dental officer available who will cheerfully shoulder the responsibility of saying "yes" or "no."

The detection of actual disease, deformity or weakness of the body or internal organs, is, after all, but the normal practice of a medical officer's profession, nevertheless, the figures tabulated below tell their own tale; and, whilst those in column 3 may be called medical officers' mistakes (some justifiable, others questionably so), columns 2 and 4 also undoubtedly contain many cases which are practically medically unfits. These figures refer, as do all others in these notes, to a period of six months, and here concern a total of 300 recruits joining two regimental depots during that time, about one-third of whom, at the time of taking the count, had been only some two months in training, the remainder for varying periods up to six months.

TABLE III.—SHOWING DISCHARGES FROM THE SERVICE OF RECRUITS BEFORE THE COMPLETION OF THEIR TRAINING.

Date of discharge. Month	Under age	Medical grounds	By Regimental Boards	All other causes	Total
Under 1 ..	6 ..	24 ..	— ..	9 ..	39
1—2 ..	2 ..	6 ..	7 ..	— ..	15
2—3 ..	5 ..	4 ..	3 ..	3 ..	15
3—4 ..	1 ..	4 ..	2 ..	1 ..	8
4—5 ..	— ..	— ..	1 ..	— ..	1
Totals ..	14	38	13	13	78

Principal causes under column 3 (Medical Grounds) :—

- (1) Defects of the lower extremities = 11
- (2) D.A.H. (tachycardia) .. = 9
- (3) Otitis media = 7

The number of apparently healthy young men who do not appear to be affected with any cardiac abnormality appreciable to percussion or auscultation and who yet have a pulse-rate, normal to them, of over 100 beats

per minute is quite remarkable, and seems to differ, as one might expect, in different districts. Table IV shows the percentages at different rates per minute in a series of 133 cases taken without reference to any other quality than that they presented themselves for enlistment and were all under 22 years of age. Special care was taken to avoid the effects of excitement or exercise and no case of valvular disease or obvious undue cardiac enlargement is included.

TABLE IV.

Pulse-rate per minute	} from to	61 70	71 80	81 90	91 100	101 110	111 120	121 130	131 over	Total
Numbers	..	2	24	40	33	4	12	11	7	133
Percentages	..	1.5	18.1	30.0	24.8	3.0	9.0	8.3	5.2	

The average pulse-rate per minute of ninety men (three squads), who had been passed into the Army, taken on or very shortly after joining their depot, was 95.76; after some five to six weeks of training the average pulse-rate of sixty-eight of the remainder who had not been discharged (some being absent or sick) was 82.7; by the end of their third month the number available had dropped to fifty-seven, and their average pulse-rate was 82.84 per minute. Of these fifty-seven who survived three months the average pulse-rate at the beginning of the training was 86.56 per minute. These figures seem to agree with the general impression that the men with high pulse-rates drop out quite early in the course of training, either with D.A.H. or some other defect, though a certain number of cases of tachycardia appear to develop in the third and fourth months at the depot, and the final average pulse-rate is raised, in these cases, by three men who up to the date of recording had gradually developed pulses of just over 100 per minute. The drop in numbers is not, of course, permanently so great as would appear because on any given date there are always likely to be men absent or sick in hospital, still, it is fairly good indication of what happens to an average squad.

The whole question of the cardiac reaction to and recovery from effort is at present under the consideration of a War Office Committee and is therefore not considered here.

When we come to consider those constantly related measurements of height, weight and circumference of the chest, and to assign the different values to be allotted to each individually and to all together, we begin to tread on more difficult and interesting ground. The minimum height at which a recruit may be accepted for the Service is governed very largely by the interaction of the rates of supply and demand, and the low limits of all these three factors are standardized, from time to time, in Regulations.

The proper relationship between height, weight and chest has been worked out by Professor Georges Dreyer and tabulated in his book, "The Assessment of Physical Fitness." He uses the length of the trunk not the length of the whole body (i.e., the height sitting not standing) as the

standard of height, and the mean or ordinary circumference of the chest, not the maximum or minimum, and also takes the vital capacity of the lungs. Calculations from these tables materially increase the time taken for the examination of recruits, but they do give data comparable with accepted normal standards for the estimation of the physical worth of any individual with whom one is dealing; and they have the advantage that they are applicable to all ages without alteration. Taking the measurements easily obtainable in the examination of recruits, it would appear, roughly from a small number and using the weight calculated from the trunk length as the most reliable in dealing with numbers according to Dreyer's recommendation, that the average recruit on enlistment is some seven per cent below the normal weight for a man of his size, though he is up to, or over, the regulation weight for recruiting.

In the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS for January, 1913, Lt.-Col. (then Captain) J. A. Balck Foote, R.A.M.C., showed that it was possible by modifying the original formula, to make use of Pignet's factor for the estimation of the physical condition of men from figures available on their medical history sheets, and to classify men by the use of this formula. Thus, if the height in inches is subtracted from the sum of the weight in pounds and the maximum circumference of the chest in inches a "factor" is obtained which will give one a mental picture of the state and worth of the individual's development ($F = (W + C) - H$): and the values of various factors arrived at in this way are given by Balck Foote as:—

Under 80	..	Useless
80 to 90	..	Weak
90 to 100	..	Fair
100 to 110	..	Good
110 to 120	..	Strong
120 upwards	..	Very strong

Provided that there is no excessive fatness, or other obviously disturbing feature, these standards appear to be reliable and the factors obtained do give a remarkably reliable indication of the subject's physical value at the recruiting ages. I have not had sufficient experience in the recruiting of boys to be able to say whether it is of the same value between the ages of 14 and 17 years, but as this is a time of rapid growth in height—usually at the relative expense of weight, probably the above classification requires considerable modification.

The standards laid down at present for recruiting for infantry of the Line, if worked out on this formula, give, for the various ages and heights, a minimum factor as shown below:—

At the age of		TABLE V. Minimum factor for a height of							
		63	..	65	..	68	..	70	.. 72 inches
18	..	84	..	83½	..	84	..	..	84½
19	..	84½	..	86	..	86½	..	87	91½
20	..	85½	..	89	..	89½	..	91	93½
21	..	86½	..	90½	..	91	..	92½	96
22 and over	..	90½	..	92½	..	93	..	95½	97

These standards, it must be remembered, are for untrained men, and may be assumed to be the lowest from which it is considered reasonable to expect it to be possible to produce strong and efficient soldiers as the result of at least five months' special training. It will be noticed that the standards printed in black figures—i.e., 18 to 20 years and sixty-three to sixty-eight inches height—which include the vast majority of normal recruits, are in the eighty to ninety, or "weak" class.

One point which I have tried to arrive at is the standard from which, as a start, the average healthy recruit may, with any degree of certainty, be expected to turn into a promising soldier by the end of his course of training at the depot. Omitting therefore those who fall by the wayside, and considering only those who arrive at the end of their training fit to be passed on to the battalion, the average factor of 156 recruits who have been drafted to their battalions for two regimental depots during the six months under consideration was 93·99 at the time of their enlistment, and 103·67 on completion of training—an increase of 9·68 points. These figures represent, for an average of eighty-eight of these men, an initial weight, chest and height measurement of 125·43 pounds, 35·24 inches and 65·86 inches respectively, and final measurements for 125 men of 133·54 pounds, 35·93 inches and 66·52 inches. Taking the figures in different detail, the following table shows the average finishing factor of men who started at various points on the scale, and shows, for this series, that even if we take a factor of from 100 to 110 as a satisfactory point at which to arrive by the completion of a recruit's training (allowing for the fact that the majority have still two or more years in which to continue growing), we ought not to look too hopefully on any recruit who has, on enlistment, a factor of less than 90, and not too certainly on one of less than 95. In other words, the recruit who is just up to the regulation standard and not very much more, is not likely to be of much real value. Naturally, a percentage of such men do survive to become efficient soldiers, but my personal feeling is that only those who are particularly keen to do so survive, and as this class includes most of the men who are driven to the Army as unfit for anything else, they do not, as a rule, merit any great expectations. As a general rule, it seems to me, the basis of their failure is their insufficient weight.

TABLE VI.

Factor on enlistment			Average factor at end of recruit training			Numbers
Below 80	..	..	89·475	..	..	13
80—84	..	..	95·207	..	..	21
85—89	..	..	99·52	..	..	22
90—94	..	..	101·33	..	..	31
95—99	..	..	106·06	..	..	25
100—109	..	..	112·80	..	..	33
110 and over	..	..	118·58	..	..	11

One constant feature which has always to be kept in mind is the normal strains to which a soldier is likely to be subjected as a trained man, the

most constant and, perhaps, the most severe of which is the amount of weight which he will be required to carry. Professor Cathcart and Captains Richardson and Campbell, R.A.M.C., have recently demonstrated that the optimum load of the soldier should not exceed one-third of his body weight under ordinary service conditions, which, as they point out, taking the average body weight in the Army as 135 pounds, means a load of some forty-five pounds. The weight of full marching order (without the great-coat) is, at present, fifty-seven pounds three ounces; so that the average weight given above for this series of recruits at the end of their training may be taken as the least that is desirable; for, provided that he keeps in good training, the soldier is not ordinarily likely to gain very much in weight after he leaves the depot. Indeed, if the figures given above for small numbers in any way correspond to the general rule, he has but a couple of pounds to gain, on an average, to bring him up to the standard of the Army as a whole. I have laid stress on the question of weight because it has seemed to me to be, if any one thing is, the most important determining factor in the successful selection of recruits both from the military and from the purely economical points of view under the present system of training. The light-weight man seems not to have sufficient basis on which to build, nor sufficient reserve on which to draw, so that he may survive the period of intense training at the depot; of course modification or delay in training might save a percentage of these men, but it is questionable whether, on the whole, such a proceeding would be really economical.

It would be interesting to know whether this question of weight, and more particularly of regular gain in weight, bears any definite relation in the recruit to the incidence of D.A.H. during training; and whether, as I suspect, it might not be possible by watching fortnightly weight charts to predict and prevent the occurrence of disabling tachycardia by delaying or modifying the training of those who are not gaining weight at the normal rate.

There is an abundance of material for such investigations, but, as anyone who has started on them in the course of ordinary duties will know, there are many obstacles to the successful collection of statistics and gathering of impressions and ideas, not the least of which are the amount of time which can be made available and the length of time over which continuous observations should be carried out.

OBSERVATIONS ON THE INCIDENCE OF TYPHUS FEVER IN PALESTINE WITH SPECIAL REFERENCE TO TYPE AND DIAGNOSIS.

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THE winter of 1915 found Palestine suffering from the inevitable concomitants of war, and soon to the miseries of a people whose resistance was already enfeebled by privations was added the further scourge of typhus fever which rapidly overran the land. Doubtless introduced by Turkish troops transferred through Asia Minor and Syria to Palestine from infected war fronts, the fever raged in epidemic form during 1916 and 1917 up to the time of British entry and for several months thereafter.

The period of maximum incidence may be regarded as at an end by April, 1918, although from this date until March, 1919, cases numbering 121 were recorded.

From April, 1919, to March, 1920, however, only four cases were notified during the twelve months, and the remaining nine months of 1920 added but thirteen to the list.

Although from 1921 to the present day—the period more especially under review—neither in regard to the number of persons affected nor the severity of the disease can comparison with the previous period accurately be drawn; nevertheless, since 1921 there has existed, and there continues to exist, a condition of affairs presenting for consideration a complex problem of remarkable interest.

This condition may best be appreciated by an analysis of the cases recorded during these three and a quarter years:—

1921 totalled 63 cases; 49 occurred among Jews, of whom 46 resided in the Jaffa area.

1922 had 33 cases, 29 being Jews—26 of these resident in the Jaffa area.

1923 showed 35 cases; of this number 28 were Jews, of whom 22 belonged to the Jaffa area.

The total and racial incidence throughout Palestine is set forth below:—

TABLE I.

Year	Total cases (Moslems, Christians and Jews)	Jews affected	Jaffa area	
			Total cases (all religions)	Jews affected
1921	63	49	48	46
1922	33	29	27	26
1923	35	28	25	22
1924 (3 months) ..	6	5	5	4
Totals (3½ years) ..	137	111	105	98

From these figures three facts may be observed :—

- (1) Of the total 137 cases, eighty-five per cent are Jews.
- (2) The number of cases occurring in the Jaffa area is 76·6 per cent of the total incidence throughout Palestine.
- (3) Of the cases occurring in the Jaffa area 93 per cent are Jews, and this represents 71·6 per cent of the total cases in Palestine.

Table II emphasizes the peculiarity of the distribution in detail, and is made clear by reference to the map incorporated in the text.

TABLE II.

District	Town or Village	1921	1922	1923-24	Total
Southern	Jaffa	27	23	24	74
"	Petah Tikvah	9	3	0	12
"	Ramleh	2	1	3	6
"	Richon	3	0	1	4
"	Rehoboth	3	0	2	5
"	Surafend	1	0	0	1
"	Gaza	2	1	3	6
"	Small villages	3	0	0	3
Jerusalem	Jerusalem	6	1	3	10
Northern	Haifa	2	2	1	5
"	Safed	2	0	0	2
"	Tiberias	2	2	3	7
"	Tulkarem	1	0	0	1
"	Beisan	0	0	1	1
Total throughout country		63	33	41	137

This summary provides the further information that while in Jaffa and its environs occurred 105 cases (76·6 per cent), Jaffa Town alone accounted for seventy-four cases—i.e., seventy per cent of the cases occurring in the Jaffa area, or fifty-four per cent of the total case incidence for Palestine.

What explanation can be advanced for this remarkable distribution?

Two theories naturally present themselves for consideration :—

- (1) As a result of residual infection carried over from the epidemic years 1915-1917, it might reasonably be expected that, once the epidemic had spent itself, cases of a more or less sporadic nature would tend to occur just as fresh susceptible persons appeared and accumulated in what might be termed endemic foci.

The second depends on the entry of immigrants from countries where the disease had been for several years epidemic. Such potential infection would, of course, be restricted to that part of the population, local or immigrant, not rendered immune by previous attack.

Now, in Palestine, during the years following the epidemic, the curve of incidence rapidly declined until 1921, when it again showed a very appreciable rise on the occurrence of sixty-three cases. Of this number forty-nine were Jews, forty-six of whom (ninety-four per cent) resided in the Jaffa area.

In accordance with the terms of the Mandate, immigration into Palestine was formally permitted as from September 1, 1920, and from that date till to-day, 31,551 Jews have entered.

Had these immigrants hailed from countries free from past or present typhus, "residual infection" would be adequate explanation for the outbreak which occurred largely among the immigrant population; but in point of fact the vast majority came from those parts of Middle Europe wherein the disease had raged both during and after the Great War.

Jaffa, moreover, is the main port of entry and chief industrial centre in Palestine for Jewish immigrants, and in Jaffa and its immediate environs those immigrants are lodged and employed until their dispersal to various settlements in and near towns throughout the country.

The striking disproportion amongst those attacked, both as regards races and localities affected, might with some reason urge one to lay stress on the probability that the disease was introduced *de novo* by recently arrived immigrants, especially also when one has regard to the low rate of incidence among the local inhabitants of Jaffa—doubtless due to immunity conferred by the epidemic years.

A parallel to this suggested mode of introduction and to the position generally is to be found in New York.

Rosenau [1] remarks: "It is now evident that typhus fever has been smouldering in New York a great many years, certainly since 1896, when Brill first observed the cases which he described. The disease in New York is generally mild. It is believed that some cases are not diagnosed; therefore we face a new sanitary problem in this country. Typhus fever in virulent form is now (1921) being re-introduced into the United States with the tide of immigration from epidemic centres." Which of the two possible modes of origin plays the greater part in the production of present-day conditions is not clear. Castellani and Chalmers [2] state that "Typhus fever appears to occur only in epidemic form in Asia Minor and Syria," but to-day it would be correct to say that the disease as it now obtains owes its continuance to the presence of endemic foci left after the epidemic of 1915-1917, or to its re-introduction by recent arrivals—immigrants from typhus-stricken countries—or to a combination of these factors.

Type of Typhus.—The extraordinary mildness of the disease may be observed from the subjoined figures:—

TABLE III.

Year		Total cases		Total deaths		Percentage
1921	..	63	..	5	..	8
1922	..	33	..	0	..	0
1923-4	..	41	..	1	..	2.4

Six deaths therefore have occurred out of 137 cases, a mortality of 4.4 per cent.

It is recognized that in countries where typhus has been epidemic and where, as a consequence, immunity exists, the type may be mild, even of an ambulatory nature. As a result both in respect of its onset and symptomatology it may be readily confused with a light paratyphoid fever.

To Palestine this can be well applied inasmuch as its present-day inhabitants consist of two populations :—

(1) That resident before and during the Great War.

(2) That resulting from immigration since September, 1920. Both of these populations have, during recent years, belonged to countries where typhus has been present in epidemic form.

Careful records kept of those cases occurring during 1921 show that the disease as observed in the sixty-three cases can be described under three heads :—

(1) Six showing typical ataxo-adynamic symptoms.

(2) Fifty-one where the term " mild clinical typhus " may be applied.

(3) Six atypical.

The six classified under (1) showed profound prostration, grave nervous signs, proceeding towards the typhoid state, and death.

The fifty-one mild clinical cases showed a type of typhus without loss of consciousness, delirium, or other marked nervous symptoms. These cases mostly inclined towards the adynamic. The rash although usually typical yet appeared at times as an abdominal erythema only, or a sub-cuticular mottling without any evidence of the other elements necessary to produce the " mulberry rash."

The variability in the time of the appearance of the rash, and in the nature and duration of the temperature, and indeed the symptoms generally presented a picture of typhus far removed from that of the textbook. Two cases were ambulatory and continued work undiagnosed, being finally admitted to hospital with a fading rash after eight days malaise.

If one reckons the onset of the disease to synchronize with the first definite elevation of temperature, it is noteworthy that on five occasions the rash appeared later than the fourth day, viz., once on the sixth day, once on the seventh day, four times on the eighth day, and once on the ninth and thirteenth days respectively.

The six described as atypical are so grouped mainly on account of the complete absence of a rash of any kind throughout the course of the disease.

Here the only evidences of illness were: temperature of moderate degree and varying duration, a mild degree of prostration and a condition in general resembling mild paratyphoid fever.

Cases occurring during 1922-23-24 and totalling seventy-four may be classified :—

(1) Ataxo-adynamic	..	..	1
(2) Mild clinical typhus	..	..	61
(3) Atypical	..	..	12

The combined incidence of the three and a quarter years then shows a total of 137 cases which may be divided into the three types :—

Type	Number	Percentage of total
(1) Ataxo-adynamic	7	5.1
(2) Mild clinical typhus	112	81.8
(3) Atypical	18	13.1

From this it will be seen that those cases in which no rash appeared throughout the course of the disease number eighteen and represent 13·1 per cent of the total.

This matter of the absence of a rash is one concerning which there is much diversity of opinion.

Arkwright and Willcox state that "typhus fever in our experience is always associated with a rash" [3]; Ker [4] points out that "the spots and mottling occur to a greater or less extent in practically all cases of the fever"; Castellani and Chalmers [5] describe typhus sine exanthem as one of the varieties of the disease; while Schamberg [6] says: "In exceptional cases the rash of typhus may be absent, constituting the so-called typhus sine exanthemate."

"Murchison failed to discover a rash only fifty-five times out of 2,499 cases, i.e., in 2·2 per cent."

Diagnosis by means of the Weil-Felix Reaction.—The majority of the earlier reactions performed for the Jaffa area were undertaken by Dr. A. Felix—co-discoverer of the test—and during 1923 and 1924 reactions were frequently carried out simultaneously by the Government Central Laboratory at Jerusalem and the Hadassah Laboratory at Jaffa for corroboration and control of findings.

It is noteworthy that not in one single instance was there any discrepancy in the results obtained by the workers in these laboratories.

Of the total cases reported typhus during 1921—i.e., 63—57 were clinically positive, and 6 atypical, clinically negative:—

Number of cases in which the Weil-Felix reaction was performed	=	56
" " clinically positive, Weil-Felix reaction positive	=	50
" " " " " " negative	=	0
" " " negative " " positive	=	6

It will thus be observed that the cases described as clinically positive gave without exception a positive Weil-Felix reaction.

The fact, however, that six cases clinically negative reacted positively to the Weil-Felix test, and that the diagnosis of the six rested almost entirely on the bacteriological finding, caused a certain element of doubt to arise regarding the value of the reaction; that is to say, doubt was expressed as to whether these cases were actually typhus or not.

Careful records kept during the following years showed conclusively that quite a high percentage of cases give a positive Weil-Felix reaction without, however, presenting any of the classical symptoms of the disease. It has been considered expedient, however, to regard such cases as true typhus of a mild type, because, were one to disregard here the readings of the Weil-Felix reaction, the cases, clinically undiagnosable, would soon bring us face to face with a sanitary problem similar to that referred to by Rosenau.

Analysis of the statistics for 1922-24 shows:—

Total cases reported	74
Cases clinically positive	62
,, ,, negative	12
Number of cases in which the Weil-Felix reaction was performed	= 65
,, ,, clinically positive, Weil-Felix reaction positive	= 52
,, ,, ,, ,, ,, negative	= 1
,, ,, ,, negative	positive = 12

By combining the total figures for the 3½ years:—

Cases clinically positive Weil-Felix reaction positive	= 102
,, ,, ,, ,, ,, negative	= 1
,, ,, negative	positive = 18

A brief résumé of those puzzling cases clinically not-typhus will serve as an example of difficulties in diagnosis, and will preface impressions gained since 1917 by personal experience of Weil-Felix reaction.

Case 1.—Admitted to hospital as paratyphoid fever; temperature of seven days' duration, fastigium 103°; slight headache, malaise, no rash. Weil-Felix reaction performed (a) on sixth day of disease; positive 1 in 50 dilution of serum; (b) on eighth day, positive 1 in 200. No agglutination was obtained in any dilution of serum with any member of the typhoid, paratyphoid or Brucella groups.

Case 2.—Slight headache, malaise, moderate temperature, mild prostration, no rash. W. F., reaction on ninth day was negative; on twentieth day was positive in dilution of 1 in 400 patient's serum. No agglutination with the typhoid, paratyphoid or Brucella groups.

Case 3.—Abdominal tenderness, five days' diarrhoea, temperature 101-103°, severe headache, spleen palpable; clinical typhoid, but no rash. W.F. reaction positive in a dilution of 1 in 400 on the eighth day and positive 1 in 3,200 on the twenty-third day. No agglutination with the typhoid, paratyphoid or Brucella groups.

Case 4.—Only symptoms: moderate headache, fever and prostration, no rash. W.F. reaction positive 1 in 200 on the eleventh day, and in serum dilution of 1 in 400 on sixteenth day. No agglutination obtained with other groups of organisms.

Case 5.—Diagnosis on admission? Malaria? Typhoid. No rash, no characteristic symptoms. W.F. reaction performed on fourteenth day gave positive result in serum dilution of 1 in 200. No agglutination with other organisms.

Case 6.—Admitted undiagnosed. Serum on twelfth day agglutinated *B. proteus* X₁₉ strongly in 1 in 200 dilution. No other organism agglutinated.

Case 7.—Admitted as clinical typhoid or paratyphoid. The following agglutinations were obtained in the dilutions of serum indicated:—

Day of disease	<i>B. proteus</i> X ₁₉	<i>B. typhosus</i>	<i>B. para</i> A	<i>B. para</i> B	<i>M. melitensis</i>	<i>B. para</i> M.
6th ..	1 in 200 ..	1 in 100 ..	— ..	1 in 100 ..	— ..	— ..
12th ..	1 in 1,600 ..	1 in 100 ..	— ..	1 in 100 ..	— ..	— ..

It is to be noted that this patient had shortly before received a course of Besredka's antityphoid tablets administered by the mouth.

Case 8.—Admitted suffering from intermittent fever and headache; ? malaria. W.F. reaction positive on ninth day in a dilution of 1 in 100; and positive on eighteenth day in 1 in 400. No agglutination with typhoid, paratyphoid or Brucella groups.

Case 9.—Temperature 102 to 103°, lasting fourteen days. Spleen palpable, intense headache, prostration, but no rash. W.F. reaction positive on fifth day, in serum dilution 1 in 100, and on nineteenth day in a 1 in 400 dilution. No other agglutinations obtained.

Case 10.—Ambulant case; temperature lasting four days, headache, malaise, no rash. Remained undiagnosed for eleven days when W.F. reaction was positive in dilution of 1 in 100. No agglutination with the typhoid, paratyphoid, and Brucella groups.

Case 11.—Intense headache, backache, spleen and liver enlarged; no rash.

W.F. reaction (a)	positive	5th day	..	..	1 in 50
" "	(b)	"	9th	" "	1 in 100
" "	(c)	"	12th	" "	1 in 500
No other agglutinations obtained.					

IMPRESSIONS OF THE WEIL-FELIX REACTION GAINED SINCE 1917.

Of the extraordinary value of this reaction as an aid in the diagnosis of typhus fever, one was at an early date convinced, although at first by many clinicians here it was regarded not only with scepticism but with definite antagonism.

Three factors contributed towards this attitude of doubt:—

- (1) The reaction was non-specific; was heterologous.
- (2) The *B. proteus* X₁₀, with which the reaction is customarily performed, was considered to be neither the causal organism of the disease nor a secondary invader.
- (3) The unfortunate over-enthusiasm among certain workers to establish without delay the usefulness of the test led to faulty interpretations, due perhaps partly to errors in technique, the use of too highly concentrated sera, or to biased readings.

Personal demonstrations of *Sp. recurrentis* and *Plasmodium falciparum* in the blood of patients diagnosed typhus, emphasized on occasion the need for caution in accepting early results.

Inasmuch as the discoverers of the reaction maintained that the sera from cases suffering from diseases other than typhus, and even sera taken from healthy people (ten to twenty per cent) gave agglutination with *B. proteus* X₁₀ in dilutions of 1 in 25 up to 1 in 50 (rarely), it became an obvious necessity to determine a standard below which the results should be disregarded.

This standard has been variously set at 1 in 50, 1 in 80, 1 in 100. "Bei einer Titerhöhe von 1 : 100 ist die Reaktion beweisend" [7].

Although certainly desirable, indeed imperative, to adhere to such a standard (here it is 1 in 80), it has not been universal to find that the *B. proteus* X₁₀ can be agglutinated by normal sera in dilutions over 1 in 10. Here normal sera controls have invariably been without reaction. It has been found also that sera taken from persons known to be suffering from diseases other than typhus show little or no tendency to agglutinate this organism in what may be termed "diagnostic dilution." Experiments made on several occasions here with normal sera, and with sera taken from cases of malaria, relapsing fever, typhoid and paratyphoid fevers, and the dysenteries, have practically never given any agglutination above 1 in 15 or 1 in 20 unless the case showed a history of previous typhus.

In this connexion it is of interest to examine reputable high titre agglutinating sera and note how little response to the *B. proteus* X₁₀ is given.

During the past year only four sera had power to agglutinate at the same time other organisms than the *B. proteus* X₁₀.

Case	<i>B. proteus</i> X ₁₀	<i>B. typhosus</i>	<i>B. para</i> A	<i>B. para</i> B	<i>B. gaertner</i>
1 ..	1 in 200 ..	— ..	1 in 50 ..	— ..	—
2 ..	1 in 1,600 ..	1 in 100 ..	— ..	1 in 100 ..	—
3 ..	1 in 200 ..	— ..	— ..	— ..	1 in 50
4 ..	1 in 50 ..	1 in 200 ..	1 in 100 ..	— ..	—

Cases 1 and 3 were clinical typhus; Case 2 was typhus, but had shortly before received a course of Besredka's anti-typhoid vaccine; Case 4, later definitely established as typhoid, had a history of previous typhus.

In passing it may be mentioned that in one case of acute tuberculosis the serum gave a 1 in 50 reaction, with the *B. proteus* X₁₀, but here again the patient had had typhus one year previously in Poland.

Although the "reaction standard" is of value, of much greater practical importance is the fact that the height of the titre of the serum in true typhus increases towards the end of the period of temperature and thereafter during early convalescence.

The necessity in cases of doubtful diagnosis (i.e., where the patient's serum has either no agglutinating power, or the power in low dilution only, to agglutinate more than one organism) for repeating the performance of the serological reactions every three or four days throughout the disease until the height of the titre for a particular organism makes the diagnosis certain, cannot be too strongly emphasized.

Before the end of the second week of typhus fever a titre of over 1 in 80 will certainly be obtained where no agglutination reaction was visible during the first week; while in cases where the patient's serum agglutinates more than one organism in low dilution—re-examinations will determine for which organism the titre rises, and for which for practical purposes it remains, so to speak, constant.

Authorities claim that 75 per cent. of cases are positive on the fourth day of the disease, and the subjoined table is inserted to illustrate from fifteen selected cases the marked variations in the day of appearance

of the reaction, and in the relative strength of the reaction on corresponding days.

TABLE V.—VARIATIONS IN THE DAY OF APPEARANCE OF REACTION AND IN THE HEIGHT OF TITRE IN TYPHUS SERA.

Case No.	Day of disease	Dilution of serum agglutinating <i>B. proteus</i> X ₁₀	Day of disease	Dilution of serum agglutinating <i>B. proteus</i> X ₁₀	Day of disease	Dilution of serum agglutinating <i>B. proteus</i> X ₁₀
1 ..	5th	—	16th	1 : 200	—	—
2 ..	5th	—	9th	—	12th	1 : 200
3 ..	5th	1 : 100	19th	1 : 400	—	—
4 ..	6th	—	10th	1 : 400	16th	1 : 800
5 ..	6th	—	10th	1 : 400	18th	1 : 800
6 ..	6th	—	12th	1 : 200	—	—
7 ..	6th	1 : 50	8th	1 : 200	—	—
8 ..	6th	1 : 50	9th	1 : 100	12th	1 : 500
9 ..	6th	1 : 200	12th	1 : 1,600	—	—
10 ..	8th	—	15th	1 : 400	—	—
11 ..	8th	1 : 200	—	—	—	—
12 ..	8th	1 : 400	23rd	1 : 3,200	—	—
13 ..	9th	—	20th	1 : 400	—	—
14 ..	9th	—	20th	1 : 400	—	—
15 ..	9th	1 : 200	—	—	—	—

Cases 4, 5, 9 and 12 serve to demonstrate that in mild forms of typhus the agglutinating power of the serum cannot be always limited to dilutions between 1:200 and 1:500 (absolute maximum)—the range generally accepted.

Zones of no reaction, or zones of inhibition described so often in connexion with other reactions [8, 9, 10], occur here also. The phenomenon early noted and commented on by Weil and Felix [11] finds further expression in the statement of Archibald [12]—"in the stronger concentrations of serum the agglutination sometimes fails, but this difficulty may be overcome by heating the serum for thirty minutes at 56° C. before use."

To summarize then the foregoing :—

CONCLUSIONS.

(1) In clinical typhus fever the Weil-Felix reaction is positive at some time or other within the first twelve days of the disease in 100 per cent of cases in the diagnostic serum dilution of 1 in 80 or over. Failures to obtain positive results may be due to :—

(a) Variation in the day of appearance of the reaction—and this failure is overcome by repeating the performance of the reaction at intervals between the third and twelfth days of the disease.

(b) "Zones of inhibition"—"zones of no reaction" occurring in the lowest dilutions—this occurrence may be obviated by heating the serum prior to the performance of the test for thirty minutes at 56° C.

(2) The Weil-Felix reaction has not been found to give positive results

with normal sera, nor, except in low dilution, with sera of patients suffering from diseases other than typhus.

(3) The Weil-Felix reaction is positive in diagnostic dilutions (1 in 80 and over) of sera taken from cases showing no characteristic symptoms of typhus—cases termed clinically atypical and negative. Such positive results, in my opinion, indicate a mild form of true typhus which without the aid of the Weil-Felix reaction would remain undiagnosed, would be overlooked, and would constitute for Palestine the same sanitary problem referred to by Rosenau in the extract quoted above dealing with New York.

(4) In cases of doubtful diagnosis where either no agglutination whatever is obtained or agglutination of more than one organism in low dilution of serum only, it is imperative to repeat the agglutination reactions.

Diagnosis is established:—

(a) When, in the absence of other positive agglutination results, the Weil-Felix reaction is positive in a dilution of patient's serum of 1 in 80 or over.

(b) When the titre of the serum under investigation shows as the result of successive examinations an undoubted increase in respect of the *B. proteus* X₁₉, without however showing a corresponding increase towards the other agglutinable organisms.

(5) The reaction has been found to persist in a dilution of 1 in 50 patient's serum, one year after an attack of typhus fever.

(6) Even in cases of extreme mildness the titre of the serum may be as high as 1 in 1,000 or over.

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DIPHTHERIA IN SECUNDERABAD.

BY CAPTAIN S. SMITH.

Royal Army Medical Corps.

DURING the past year we have been confronted by a small somewhat anomalous outbreak of diphtheria, and it is thought that a short clinical account of our series of cases both diagnosed and suspected might be of interest.

In the early part of the year we heard that Bangalore (some 422 miles away) had suffered and was suffering from a somewhat severe visitation of the disease, and that several deaths had resulted. Bangalore serves as a hill resort for our married families of this station during the summer months, so we were fully prepared for an extension to this station, and as a routine measure swabs were taken from all cases of sore throat, even of the most simple clinical variety.

On September 6, 1923, I was called in to see Mrs. H., who complained of sore throat and headache. She told me that she had only noticed the throat to be sore the day before, and that since then it had very rapidly become worse; she had slept badly, and now complained of difficulty in swallowing. On examination her throat was seen to be intensely congested and there was considerable swelling of the soft palate on one side. Both tonsils were swollen and congested, and on the right tonsil there was what appeared to be a small quantity of inspissated pus adhering to it. Clinically the throat resembled an acute quincy. Her temperature was 103° F., colour and general condition were good. Swabs taken from both tonsils were examined direct and cultures were made on blood serum agar with negative result. By the following morning the throat condition had not improved on ordinary symptomatic treatment, and as there was now a definite "patch" on her right tonsil an injection of 4,500 units of diphtheria antitoxin was administered after a preliminary swabbing of the throat. Again no K.L.B. were found, either direct or on culture. By the following day her throat condition had almost subsided, there was no membrane to be seen and she made an uninterrupted recovery, except for a severe serum reaction with marked urticaria which occurred a week later and for which she had to be treated in hospital. Many subsequent swabs were taken with negative results.

Three weeks later I was called in to see Mrs. H.'s husband, whom I found to be suffering from an acute sore throat of exactly the same clinical variety as that from which his wife had just recovered. He was running a temperature of 103° F., there was much faucial and peritonsillar swelling and congestion with a small exudate of muco-pus on the left tonsil and he also gave a history of acute onset the day before. A throat swab was taken

and he was removed to hospital. The first throat swab gave negative results, but a second taken on the day subsequent to admission showed K.L.B. in pure culture both in a smear made direct from the swab, and after culture on serum agar. 10,000 units of diphtheria antitoxin were given at once, 8,000 units on the following day and 3,000 units on the third day. By this time the membrane which had developed on the day of admission to hospital, and had spread rapidly all over his left tonsil and left side of his uvula but which had never encroached on to the right tonsil, had peeled off and his throat appeared normal. No further antitoxin was given. Curiously enough, like his wife, he developed a very severe antitoxin urticaria with marked constitutional disturbance a week later. Unfortunately, signs of acute cardiac failure developed thirteen days after admission, and he died on the fourteenth day.

On September 21, 1923, I was called in to see Lieutenant T. who complained of a sore throat and who was rather apprehensive as he had danced three days previously with a civilian lady who had only that day been sent to hospital suffering from a mild sore throat from which K.L.B. had been isolated. On examination of Lieutenant T.'s throat he was seen to be suffering from a very mild congestive condition of the fauces, tonsils and pharynx with considerable glandular enlargement. His temperature was 99° F. and he looked rather pale and washed out. There was no trace of membrane and frequent swabs proved negative to K.L.B. His sore throat cleared up under ordinary symptomatic treatment in a few days.

Some three days later I was called in to see Miss C., a children's governess, who complained of sore throat and headache, and gave a history of having danced with Lieutenant T. a few days before he reported sick, and also having been to see Mrs. S., the lady from whose throat K.L.B. had been isolated. She also had a sore throat of the same variety as Lieutenant T., with considerable involvement of the glands on the right side of her neck. She appeared seedy and washed out, her temperature was 99° F. and no trace of a membrane was to be seen. Swabs were taken every morning for ten days but all were negative. A week after the onset of the sore throat a very small area of what appeared to be membrane was seen deep down in the cleft remaining after the removal of her right tonsil some years previously. During this week she made no headway, her throat continued "mildly sore," she felt ill and out of sorts, and she ran an evening temperature in the neighbourhood of 100° F. 4,000 units of diphtheria antitoxin were then administered. The following day she complained of no soreness in her throat, her temperature remained normal, and she was quite fit again within a few days.

On September 23, 1923, a small boy, Leslie P., aged 6, was admitted to the family hospital suffering from sore throat and post-nasal catarrh. The sore throat was not unlike that from which Mr. and Mrs. H. had suffered, and there was in addition a patch of very white pellucid pseudo-membrane on one tonsil. Clinically the condition resembled a streptococcal infection

with the white glistening membrane so often met with in that condition. Swabs taken from the throat and post-nasal discharge were negative to K.L.B. After a few days symptomatic treatment, during which time the membrane had disappeared, the boy was discharged on September 26, 1923.

As the post-nasal discharge persisted another swab was taken three days later and K.L.B. were isolated. The boy was immediately admitted to hospital and 9,000 units of diphtheria antitoxin were injected. On admission the boy was pale and had a slight temperature of 99° F., a trace of albumin was present in his urine, and his heart was slightly enlarged. There was slight injection of both fauces, but no enlargement of the tonsils, and no trace of membrane was to be seen. The glands on both sides of his neck were enlarged. He had a muco-purulent discharge from the posterior naso-pharynx which persisted for three weeks, and from which K.L.B. were frequently isolated.

It is interesting to note that we have had no cases of declared diphtheria amongst the rank and file living close together in barrack rooms. There have been numerous cases of sore throat amongst them, from all of which swabs have been taken with negative result. Every case of sore throat cleared up in a few days under symptomatic treatment. The only possible example we have had of a sequela to a case of undiagnosed diphtheria was that of a young soldier who was admitted and subsequently died with symptoms of multiple neuritis, the cause of which was never diagnosed. Brief notes on this case appear below.

Case 1.—Pte. B. was admitted on November 6, 1923, suffering from weakness, ataxic gait and inability to march. His past history revealed nothing of importance, there was no history of V.D.; he was a teetotaler and he had never been in the habit of buying sweets or other food from natives. He had always eaten plenty of fresh vegetables, i.e., cabbages, potatoes, etc., with his meat. There was no history of influenza, scarlet fever, malaria, or enteric fever. There was no recent history of a sore throat, but he had suffered from a "cold" some two months previously with considerable nasal discharge.

He had been quite fit until two months before admission, when he noticed that his feet used to swell after a long march; he put this down to constriction by putties. He had noticed weakness in his legs for some time. He marched to camp some fourteen days before admission, but had to fall out owing to weakness in his legs and finished the journey by train. Vomiting after meals started a week after he went to camp. He was very constipated, but there was no headache.

On admission the patient was pale and thin, and appeared mentally rather dull. He was very constipated for three days. He walked with a well-marked high "steppage" gait owing to weakness of the anterior tibial and peroneal groups of muscles. He also appeared to walk on a wide base with some ataxia (probably not true ataxia, but due to weakness of

dorsi-flexors of the foot). The heart was slightly enlarged, with the apex beat in the fifth interspace, nipple line. There were no cardiac murmurs.

On a more detailed examination of the nervous system there was found to be marked weakness of the dorsi-flexors of both feet. He could not voluntarily flex either foot to a right angle. The other movements of the legs appeared normal, although somewhat weak. Grasps of both hands were weak, there was no marked paresis of the dorsi-flexors of the hands. Sensation and co-ordination of limbs were normal. The knee-jerks were absent, even when reinforced, the arm and ankle jerks were absent. The plantar responses were absent. The eyes were normal, pupils moderately contracted and reacted to light and to accommodation. A total white blood count gave 7,500 white blood counts per cubic millimetre, and a differential white blood count showed a relative lymphocytosis of 45 per cent lymphocytes.

From the day of admission he gradually went downhill, his weakness became more extreme, so that after a few days in bed he was unable to stand; the vomiting continued two or three times a day, and he developed diplopia and a coarse lateral nystagmus due to weakness of both external recti muscles. The discs were normal, with clear-cut margins, but there was definite engorgement of the retinal veins. A lumbar puncture was performed, but the cerebro-spinal fluid was normal, and not under tension, nor was there an increase in the cell content. Serum for a Wassermann test was taken, but unfortunately it became contaminated during transit. He finally died of sheer exhaustion eleven days after admission. A detailed post-mortem revealed no gross abnormality. The organs were tested for arsenic with negative result. Both peroneal nerves and the two sixth nerves were removed for further microscopic examination.

The causes of peripheral neuritis are many, and this man may never have harboured K.L.B. in his throat, but it is at least suggestive that about the time he suffered from his nasal catarrh there were numerous anomalous cases of diphtheria in the station. It was thought at one time that he might be suffering from beriberi, but it is not common to meet with isolated cases of this disease amongst European soldiers where all are on the same generous diet to which, presumably, fresh meat and vegetables would have supplied a sufficiency of vitamins. It was considered possible that some metallic poison might have accounted for his condition, and washings from his water-bottle were carefully analysed with negative result. Our possible list of causes is thus sensibly narrowed, and of those remaining the toxin of diphtheria, with its known predilection for the nerves controlling the external ocular muscles, would appear to take a prominent place.

The outstanding features that emerged from a critical examination of these few scattered cases would appear to be, firstly, the atypical character of most of the throats affected, in some of which no membrane could be detected, and secondly, the very small amount of assistance afforded by

bacteriological examination of the material taken from throat swabs or from cultures on blood serum agar made therefrom. The swabs were in each case conscientiously taken early in the morning with the usual precautions before antiseptics had had access to the throat, and were as conscientiously planted on recently-prepared serum agar.

In this respect it is interesting to note that in many cases which gave negative findings to K.L.B. on culture, and also in many others in whom negative findings were followed at a later date by positive findings, a Gram negative spore-bearing bacillus grew prolifically on the blood agar. It is more than possible that this bacillus which apparently grows freely on all culture media, and which is a very constant though non-pathogenic inhabitant of the throat in this country, may have outgrown the more delicate diphtheria bacilli, thus accounting for the difficulty in obtaining positive results. Further evidence of this possibility is afforded by the fact that on one occasion a culture which after twenty-four hours contained a few colonies of K.L.B. after a further twenty-four hours produced nothing but florid colonies of the spore-bearing bacillus mentioned above.

An interesting point has been that the cases appear to fall into one of two definite clinical groups: (1) a sthenic type characterized by marked congestion of the fauces, high temperature, rapid onset, and marked prostration resembling an acute follicular or peritonsillar infection, and (2) an asthenic type characterized by mild onset and course with slight pyrexia, lassitude, pallor of the face, swelling of the glands on either side of the neck and albuminuria. It is this latter variety which in my experience is most commonly met with at home.

Each variety has apparently kept true to type during its passage from individual to individual. Thus we have the severe attacks in the case of Mr. and Mrs. H., and the much milder more insidious attacks in the case of Lieutenant T., Miss C. and the civilian, Mrs. S. Many cases of the second variety naturally get missed, and it is in these that sequelæ of which the fatal case of multiple neuritis mentioned above may possibly have been an example are to be found.

It is, of course, an established doctrine that every case of suspected diphtheria should receive immediate antitoxin treatment, even if swabs prove negative, but we are given little assistance by the authorities as to what might reasonably be taken to constitute a suspicious case, and whether in the absence of post-nasal catarrh "membrane" is to be regarded as a *sine qua non*.

My experience, such as it is, leads me to the definite conclusion that any case of sore throat, no matter how slight, especially if it be accompanied by slight fever, glandular enlargement and albumin in the urine, should be treated as a suspicious case, and should receive specific antitoxin treatment if it does not improve under ordinary symptomatic treatment with gargles and paint in a very few days. If diphtheria is known to be near at hand, possibly the safest course is to inoculate every individual suffering from sore

throat, no matter how slight, the mild cases receiving an initial dose of say 2,500 units.

A further lesson I have learnt from bitter experience is that in the case of a severe sore throat, if diphtheria be suspected, even if confirmation from the laboratory is lacking, it is unsafe to temporize, and a full dose up to 30,000 units should be given on the first day, and repeated if necessary.

In conclusion, let me add one word of advice. Never forget to examine the throat of every infant or child if called in to treat fever the cause of which is not self evident. Infants cannot, and older children often do not complain of their throats even when ulceration may exist, and we may escape disaster by making a routine throat examination, a by no means easy procedure in the case of a struggling infant.

Although diphtheria cannot be said to be common in this station, and very seldom approaches epidemic proportions, a certain number of cases occur every year, and partly on account of the insidious onset and course of the disease in this country, and partly because of the difficulty of obtaining positive bacteriological findings, antitoxin treatment is apt to be commenced too late, and the resulting mortality is high. Of three cases diagnosed last year two died. I am indebted to Captain Lindeman, M.C., R.A.M.C., for brief notes on the two fatal cases.

Case 2.—Ellen W., aged 5½, was seen as an out-patient on September 24, 1922, suffering from sore throat; the temperature and pulse were normal, there was slight faucial injection, but no trace of a membrane. The child again walked up to hospital on September 28, 1922, complaining of sore throat and slight hoarseness. She did not look ill, and the temperature and pulse were normal. The throat appeared to be in the same condition as when first seen except for a slight muco-purulent discharge which had made its appearance from the posterior nares. The child was seen in quarters on September 29, 1922, and was then very ill. There was obvious laryngeal obstruction, and dirty white patches were visible on both tonsils, swabs from which were positive to K.L.B. A large dose of antitoxin was given, and tracheotomy performed, but without avail, and the child died on the same day.

Case 3.—Ellen M. was admitted on October 11, 1922, with the following history. While at school the day previously she had complained of sore throat and was sent home; she was seen that evening by her doctor, who sent her to hospital. On admission temperature was 103° F., pulse rate 170, respirations 28. She complained of difficulty in swallowing and the tonsils were much swollen with a dirty white slough on the surface; there was marked enlargement of the glands on the right side of the neck. Antitoxin was administered at once. A swab was negative to K.L.B. By the next day she had developed a right-sided peritonsillar abscess with fluctuation and œdema of right soft palate. This was opened and a quantity of pus evacuated. Swabs remained negative to K.L.B.

On October 14, 1922, there was less swelling of the throat, and the

breathing had become easier, but the tonsils and fauces were still covered by a necrotic sloughing membrane. On October 15, 1922, five days after admission, and six days after her first complaint of a sore throat, K.L.B. was grown on culture from the throat swab.

More antitoxin was administered. By October 18, 1922, the membrane was disappearing and the throat looked normal. On the following day, October 19, 1922, she was talking to her sister when she suddenly complained of "feeling bad," rapidly became cyanosed with respiratory distress, lost consciousness and died in a few minutes.

My excuse for writing this paper is to call attention to that group of anomalous and sporadic cases of diphtheria met with from time to time in a "plain" station such as this where diphtheria is commonly believed to be rare, in the hope that early specific treatment may become the rule instead of the exception, and the mortality rate which is at present admittedly high be thereby reduced. .



Clinical and other Notes.

A CASE OF SURGICAL EMPHYSEMA—OPERATION, RECOVERY.

By MAJOR A. G. WELLS, D.S.O.,
Surgical Specialist, Shorncliffe.

A FUSILIER was admitted to the Military Hospital, Shorncliffe, on March 5, with a history of having fallen on to a footscraper while carrying a sack of coal. He fell with the right side of his chest across the scraper. When seen by the Orderly Officer he complained of pain in the right chest, especially on breathing; crepitus could be elicited over the seventh rib, and there was a slight amount of emphysema present in this region. He was strapped and put to bed. When I saw him the next morning he was in considerable pain, and the emphysema had spread all over the right side of the chest and up the right side of the neck. Temperature 100.8° F., and pulse 100; respiration 28. There had been no hæmoptysis. He had a very troublesome cough but was bringing up nothing. No crepitus could be felt.

The following morning his condition was considerably worse, the emphysema had now spread to the other side of the chest, front and back, into the neck on both sides, and his face was also involved, both eyes being almost closed. The cough was much worse and he was in great pain. The strapping was removed. Temperature 100.8° F., pulse 100, and respiration 28. The next day the emphysema had spread still more, and now both eyes were completely closed; the face, chest, both sides back and front, the right arm and hand, and the left arm as far as the elbow were involved. Temperature 101.8° F., pulse 112, and respiration 28. His condition was now desperate, and it was obvious that if something radical was not quickly done he would die. It appeared almost certain that one or both ends of the fractured rib was sticking into the lung and holding it open. He was taken to the theatre and anæsthetized, very light anæsthesia being obtained. In spite of this, however, when no more than the skin incision had been made he stopped breathing and appeared dead. Artificial respiration, strychnine and oxygen, however, revived him, and the operation continued without further trouble. A flap was turned up below and behind the right nipple and the sixth, seventh and eighth ribs exposed. It was found that only the seventh rib was fractured, and that the end of the posterior fragment was sticking into the lung and holding the wound open. The periosteum was divided on the anterior surface of the rib and separated from the rib in front and behind. The fractured ends together with about three inches of the rib were removed. The wound in

the lung and pleura was then stitched up with thin catgut, and the external wound closed without drainage. Two hours later the patient's condition showed a marked improvement. Morphine one-sixth grain and atropine 1/100th gr. was ordered four-hourly.

The following day the patient was much more comfortable. The breathing was easier and only an occasional cough troubled him. Temperature 99° F., pulse 88, and respiration 24. There was no further spread of the emphysema, except that the scrotum was found swollen, but this I think undoubtedly existed before, and was overlooked.

My further notes on the case are as follows: March 10, the right eye is open to-day, and his general condition is very much improved; the cough is less frequent. Temperature 100° F., pulse 98, respiration 24. March 11, emphysema is generally subsiding, left eye is now nearly open, cough less. Temperature 100° F., respiration 24. March 12, both eyes fully open; emphysema much less everywhere. Wound examined to-day; quite healthy and healing. Temperature 99° F., pulse 80, respiration 24. March 20, all emphysema gone. Wound healed and stitches out. Temperature normal, pulse and respiration normal. From this time onward the patient progressed rapidly, and was eventually discharged from hospital to furlough quite fit in every way.

The chief points of interest in the case are, I think, the rarity of the condition, the extreme extent of the emphysema, and the rapidity with which the symptoms were relieved by operation.

My thanks are due to Dr. B. E. Laurence, C.M.P., for the very able way in which he gave a most difficult anæsthetic, and also to the Officer Commanding Military Hospital for permission to publish the case.

Shorncliffe, June 6, 1924.

"GREEN URINE."

BY MAJOR J. E. M. BOYD, M.C.

Royal Army Medical Corps.

ONE day during last hot weather, a fusilier of the Royal Welsh Fusiliers was sent up to the British Station Hospital, Multan, by the assistant surgeon doing duty in the defensive post.

He brought with him a bottle containing a bright green fluid which he stated to be some urine which he had passed that morning, he also stated that several other men in his platoon were similarly affected. No reason could be given by him for this. At first it was thought to be bile, and the outbreak of some new and terrible disease was considered. The fluid was tested and found to be urine, but it contained no bile salts.

The man was then asked to produce a fresh sample in the presence of the medical officer, and after hiding behind a door for a short time, he produced a sample of normal urine. He was kept under observation for

the day and then sent back to his company, being told that should he again pass green urine he was to report sick at once.

Next day he again turned up with a bottle full of a similar fluid.

On careful questioning it was elicited that the men in the company were drinking, amongst other "minerals," one known as "banana." A bottle of this was procured, together with a sample of the colouring fluid used. Both these, together with a sample of the urine, were sent to the chemical examiner, who reported that the colouring matter was, as far as he knew, harmless, being one of the aniline preparations, but the sale of "banana" was stopped. Strangely enough the same man turned up about six months later stating that he was passing "red" urine; he was again taken in for observation, and true enough he was passing red urine, the colour this time being due to blood; he appeared to be perfectly normal otherwise, and said he felt well, but a new growth of the bladder being suspected he was sent to see the surgical specialist; having left the station I am uncertain of the diagnosis.

These few notes are sent in at the suggestion of Major-General O. L. Robinson, C.B., C.M.G., D.M.S., in India, to whom the case was mentioned at his inspection some little time back. He considered that all strange happenings such as the above should be recorded in the *Journal* in case other medical officers might also see similar cases which might worry them.

A POSSIBLE CASE OF TICK TYPHUS.

BY CAPTAIN J. B. WILLIAMSON.

Royal Army Medical Corps.

THE following case may be of interest as a further example of the tick typhus type of infection described by Lieutenant-Colonel J. W. D. Megaw, I.M.S., in the February number of the *Indian Medical Gazette*, 1924. Although nothing was elucidated in this case which has any bearing on the cause or transmission of the disease, it is hoped that the recital of individual cases with their full clinical picture accompanied by a record of the usual laboratory investigations in pyrexial cases, will to some extent establish the disease as a clinical entity and show the way to further investigation.

The patient, Sergeant W., had been at the Dhana Artillery Practice Camp, Saugar, C.P., for a few days; there he felt out of sorts, but travelled to Kirkee, where he noticed some spots on his arm. He reported sick and eventually was admitted to the British Station Hospital, Poona, on what proved on cross-examination to be the sixth day of his disease.

On admission the temperature was 101° F., pulse 118, and respirations 28. His face, trunk, and limbs were covered with a maculo-papular eruption. The lesions were lentil-sized on an average, raised, firm and indurated, and of a dusky reddish colour.

The palms and soles were affected, but in this case the rash was entirely macular, as it was on the face.

The trunk was mainly affected by a papular eruption. The rash on the legs was mixed, but it was noticed that most of the macules in this region were petechial.

The patient suffered from a slight sore throat and the conjunctivæ were congested. No other abnormality was detected. The spleen, liver, heart, lungs, and central nervous system were normal. The case, except for the continued fever and petechiæ, had every appearance of secondary syphilis. With this in mind a Wassermann was done which was negative. A similar result was obtained after a provocative dose of novarsenobillon. The fever ran a continuous course between 99° and 102° F., ending by lysis on the seventeenth day. The rash began to fade following the novarsenobillon injection, but at present, thirty-four days after the beginning of the illness, and sixteen days after defervescence, the body and limbs are markedly stained though the face is free.

The following points are of special interest :—

(1) In previous articles the difficulty of detecting the rash in Indians has been emphasized. In this case the patient being a European, the characteristics of the rash could be well observed.

(2) Other similar cases are stated to have occurred in the camp last year.

(3) The patient being admitted to a hospital could be investigated. It should be noted that the Widal reactions were such as occur in soldiers who are frequently inoculated. The absence of a marked rise in the agglutinins in the second Widal is confirmatory evidence that the infection was not of the enteric group.

(4) The similarity to secondary syphilis.

(5) The reaction to novarsenobillon. The rash began to fade, but on the other hand the temperature was not normal till six days after the injection, so that the therapeutic value of salvarsan is doubtful.

(6) The blood was examined for spirochetes and rickettsia bodies with negative result.

(7) There was no history of tick bite, but the camp was known to be full of hard ticks (species unknown), and life under canvas was eminently conducive to infection by this vector.

(8) The patient had a companion with him in his tent the whole time at camp. The latter has shown no sign of infection.

CONCLUSION.

The disease would appear to be a distinct entity and very similar to the cases described in the article on Tick Typhus by Lieutenant-Colonel Megaw, I.M.S. With the exception of the presence of the rash on the face and the extremely mild constitutional disturbance, the clinical picture resembles that of Rocky Mountain fever more than any other known disease, and inclusion in the group of infections aptly described as tick typhus seems the most satisfactory diagnosis at present.

Echoes of the Past.

INTRODUCTORY LECTURE DELIVERED TO THE CLASS OF MILITARY SURGERY IN THE UNIVERSITY OF EDINBURGH, MAY 1, 1855.¹

By SIR GEORGE BALLINGALL.

Regius Professor of Military Surgery.

AGAIN, Gentlemen, I enter, without assistance, on the duties of this Chair. At the commencement of my last course of lectures I expressed myself in such a way as led my friends very naturally, and very truly, to conclude that I was prepared to retire; and the general voice of his professional brethren in Edinburgh pointed to the late Dr. Mackenzie as my successor; and of his assistance I did indeed entertain the most sanguine expectation of being able to avail myself during the present course. It is your loss as well as mine, and it is the loss of the profession, that Providence has ordered it otherwise. A memoir of Dr. Mackenzie's Life in the Edinburgh Medical Journals, both Monthly and Quarterly, as well as his private letters to me, and to other friends, show how speedily and correctly he fixed his eye on the points most essential to the health of an army—the position of encampments—the feeding of the troops—the prompt attention to the first symptoms of disease, and the cheering influence which the prospect of meeting the enemy has ever been found to exert on the health and spirits of a good soldier. He says, in a letter to me, in allusion to his own health, which had suffered before he left Varna,—“I have no doubt, however, that a day or two of the sea, and a sight of Sebastopol, will soon put us all to rights.” I shall not, Gentlemen, attempt to add any thing to the encomiums which have so generally and so justly been paid by the public press to Dr. Mackenzie's merits. It was to the 79th Regiment particularly that his services were devoted, in conjunction with his friend Dr. Scot, an old pupil of this class, and of whom he says (speaking of the comparative immunity of the 79th from cholera), “This, I have no hesitation in saying, is due to the energy and efficiency of Scot and his assistants. I have seen much that shows me more than I could have believed, the importance to a regiment of having an energetic and a good surgeon.” The manner in which my friend was cheered by the Highlanders on ascending the heights of the Alna, must have been, to a man like Mackenzie, who so rapidly imbibed the “*esprit de corps*” of a military surgeon, the most gratifying of all rewards for the services which he so largely and so disinterestedly gave. It was the cheers of the soldiery

¹ From an old book kindly lent by the late Dr. George Ballingall, St. Leonards-on-Sea.

which warmed the heart of Ambrose Paré on the ramparts of Mentz—of Percy on the banks of the Rhine—and of Larrey at the crossing of the Beresina.

[The Professor here craved the indulgence of the numerous friends who had been present on former occasions, while he laid before his pupils a sketch of the lives and writings of the Military Surgeons of bygone days; and after a short notice of the rise and progress of military surgery, particularly in the French and English armies, proceeded as follows :—]

Let us now, Gentlemen, turn from the events of the last to those of the present war—from the consequences of an autumnal campaign in Walcheren to those of a winter campaign in the Crimea—from the disasters of Flushing to the horrors of Scutari. But before going farther, I think it right to say, that if any of you have happened to look into the *Lancet* of Saturday last, 28th April, you will there have found a leading article on the introduction of the “civil element” into the military hospitals; so perfectly identical in spirit and in language with the views which I am now about to lay before you on that point, that the coincidence can only be explained in one way. That explanation I believe I am able, and I am most willing to give. I communicated, at his own request, to a professional friend in London my sentiments upon this subject, a good many weeks ago, and every sentiment in the paper to which I refer, I am prepared to adopt. If my views are correct, they cannot be too often pressed upon the profession and the Government; if otherwise, I must answer for them; I alone am responsible; *adsum qui feci in me convertite ferrum*.

The sufferings of our army in the last campaign, 1854-55, have been such as to throw those of 1809 into the shade. These sufferings are now, by common consent, attributed to insufficient clothing and shelter, insalubrious or scanty diet, and, above all, to exposure and over-work in the trenches—circumstances for which the Medical Department is surely in nowise responsible. An outcry, however, was raised against this department very early in the day, for an alleged want of bandages and dressings—a want which seems to have been nearly, if not altogether imaginary—a want which I never could very well comprehend, seeing that there were hundreds, nay thousands, of our own men and of the enemy, lying dead upon the field, each with a shirt upon his back and another in his knapsack.

When sickness succeeded to accidents, when dysentery took the place of wounds, a clamour was again raised about the want of drugs. Looking to the quantity of medical stores despatched from this country, I should, were I entitled to express an opinion, say that there was rather an excess than a deficiency. On occasions of this kind, nothing can be more important than economizing our space, and diminishing the weight and bulk of articles to be carried; and care should be taken that medicines of acknowledged power are not overlaid by those of an indifferent or questionable character, or buried, wholesale, under stores of clothing and ammunition.

When carrying on war at a distance from our own shores, and in communication with a friendly power, it is not unnatural, nor is it improper, that we should lean upon the products of the country, and no medical man in our service would dream that the means of purchasing these would be either wanting or withheld. Had an officer pledged his personal credit upon such an occasion, and been thrown into prison for the debt, the country would have speedily come to the rescue. It is a remark of some of the older writers on physic, that almost every country is found to produce remedies for the diseases prevalent in it; and it so happens that Turkey is a principal mart for some of the articles most essential in the treatment of diarrhoea and dysentery. Opium, rhubarb, and, I believe, castor oil, are there in abundance; and, if to these we add calomel, tartar emetic, and quinine (none of them bulky articles), we have almost every remedy of established efficacy in the treatment of fever and of dysentery, which have ever been the scourges of armies. I have always held an extensive knowledge of the *materia medica* to be of essential consequence to a military surgeon, and this not for the purpose of drenching his patients with drugs, but with the view that, when, upon foreign service, if deficient in the supply of one article, he should be able to substitute another of kindred properties—that he should, in short, be like a noted character in one of the old novels, Zachary Caudle, whose great merit consisted in his being a clever hand at a *succedaneum*.

Under the pressure of such sickness as that which has prevailed at Balaklava and at Scutari, I should be little disposed to indulge young surgeons in exercising their fancy, or experimenting with a variety of drugs. The administration of medicine, however necessary it may be to alleviate pain, or to aid in the cure of disease, is but little calculated to ameliorate the air of a crowded hospital, or to promote that cleanliness which, in such circumstances, is, of all medicaments, the most indispensable. I am not given to homœopathy, nor am I prepared to subscribe to the doctrine of the late Mr. Knight, the Inspector-General of hospitals at the time I entered the service, who said to a surgeon, whom he thought a little too fond of drugging, that “he would carry as much physic in his breeches pocket as would serve him and his regiment for six months; and that soldiers wanted nothing but tartar emetic, and a big stick.” The value of the tartar emetic I am quite ready to admit; and as to the big stick, the cases which suggested its use have greatly diminished since those days. Never was it less necessary than in the army of the Crimea; never was an army imbued with a better spirit; never were men more reluctant to give in, nor more patient under sufferings and privations.

One is entitled to learn wisdom from experience, and I cannot help thinking that, under a recurrence of similar circumstances to those with which the department has had to contend, the services of an assistant-surgeon, or, if you will, an apothecary to the forces, would be well bestowed, in despatching him as a sort of super-cargo with every supply of

medical stores, seeing them embarked, knowing where they were stowed, and keeping his eye upon them, until delivered to the authority destined to receive them. Were a cargo of such articles as I have pointed at, with a supply of splints and bandages, despatched successively in different transports, little could be wanting. But, above all, let no selfish, jobbing, or ignorant druggist be permitted to occupy space, and waste the public money, in supplying extract of liquorice (*Scottice*, black-sugar), instead of salts and senna. Of the former, I once saw boxes innumerable landing on the beach at Madras—a very potent remedy you will admit for sick soldiers, dying of fever, dysentery, or abscess in the liver.

It is, Gentlemen, in the hope of being able to suggest a few hints for your guidance that I have hazarded these remarks; and it is in the same spirit that I would, with great deference, advert to what, so far as I can see, appears to have been the only defect of the Medical Department—an excess of good nature, in mixing itself, or permitting itself to be mixed, with the duties, and saddled with the responsibilities of another department.

There is all the difference between the duties of a purveyor and of a surgeon, that there is between food and physic, and it would be well that these were kept as distinct in their supply as in their exhibition. There are, indeed, some articles termed “medical comforts,” such as wine and sago, brandy and arrow-root, which occupy a sort of neutral ground; and if the medical officer is ordered to furnish these, he has nothing to do but, like a good soldier, to obey; but even of these I should be glad to see him enabled to wash his hands. I do not see why he should, of necessity, be compelled to be a taster of wine or a connoisseur in brandy. If these articles are found to be faulty, there is always a means of redress through the orderly officer, who visits the hospital daily, for the very purpose of hearing complaints, and who (with all respect be it spoken) may be quite as good a judge of port wine as the doctor. Of this I am quite sure, that in the old war there were ten captains in my regiment better judges of this matter than I was. I have lived to see much in the medical department of the army—I have lived to see this department a second time declared unequal to its duties; but I trust that neither you nor I will live to see the Chief of the Medical Staff again reduced to the necessity of repelling offensive insinuations as to a missing cargo of wine.

It was my fortune to serve for some time in a quarter of the world where the purveyor, or commissary of the sick, and the surgeon were, until a recent period, combined in the same person—a combination most peculiarly favourable to the pocket of the surgeon, but not equally so to the health of his regiment. This is now happily abolished in all quarters of the world, and I am sure that no honourable or high-minded man will wish to see it revived. How far it ever was from meeting with my approbation, the following passage from my “*Outlines*,” first penned some forty years ago, will serve to show you:—“It may be very possible for a surgeon when

lying quietly in garrison or cantonment to furnish provisions for his sick without much additional trouble ; but whenever his regiment comes to be employed in active operations against an enemy, all his talents and exertions are then required in his proper capacity, and he has his hands abundantly full without having the complicated concerns of a victualling department to attend to. It by no means follows, that because a man is a good surgeon he should be a good commissary also, and it is obvious that whatever tends to withdraw his attention from the study and practice of his professional duties must ultimately prove injurious to the service." I have said much more on this subject in the passage from which I quote, but enough to show, that my opinions are not made for the occasion ; and I will only add, that I see little that the surgeon has to do with the purveyor, except to demand from him the necessary supplies for the sick ; and to report him to the General if they are not forthcoming.

It was not, however, with the differences between the purveyors and the medical officers in the hospitals on the Bosphorus that the difficulties of the medical department began. At the very commencement of this hitherto unfortunate war, long before a single shot was fired, it would appear that the most urgent representations were made by the Head of the Medical Department, and this, too, upon points of paramount importance to the health of the army—the clothing of the soldier—the formation of a numerous hospital corps—the appropriation of ships for hospital purposes, or for carrying disabled men to England, or to some intermediate station, so as to relieve the crowded hospitals at the seat of war.

How these very proper representations came to be so signally disregarded, it is not for me to explain. It may be only a part of that multiplication of office, and subdivision of responsibility of which the nation seems now so heartily sick, and which tends to render even a Commander-in-Chief in a great measure powerless. No man is better aware than I am of the evils which have arisen, and must arise, from a limited authority to the medical officers of the British army, but this would seem to have progressively increased since my time, and has now risen to a height which has placed the department not only in a false, but in a helpless and undignified position. It has risen to a height which calls aloud for a remedy, if the British soldier is hereafter to receive that assistance from the skill of the surgeon to which he has so nobly entitled himself—that assistance which I am sure it is the desire of the nation that he should receive.

In former days I have known a successful representation to issue from the weakest voice in the department. I have known an assistant-surgeon of three years' standing to bring down the censure of the Government upon the medical storekeeper at one of the presidencies of India, for hesitating to supply him, at once, with the articles he required. The young man's requisition was sent back to him for amendment, but instead of doing this, he stated the facts to his commanding officer, saying that the requisition

should stand upon record, and if the storekeeper was unable or unwilling to comply with it, it was for him to say so, and to state "the reason why." The Colonel who, at the time, commanded a large army about to take the field, galloped off with the correspondence to the Governor, by whom the storekeeper was reprimanded, and the medicines were in camp in less than twenty-four hours.

I have known a young surgeon to bring his commanding officer to book, and to carry his point, by merely hinting at the proper statement in the proper quarter. The case was this—the regiment was stationed at Nottingham, partly accommodated in barracks and partly billeted in the town. Amongst those in billets were, as often happens in similar cases, a number of men with trifling ailments, who would soon be restored to their duty, by putting them under restraint and proper treatment. For this purpose the surgeon had repeatedly applied to the commanding officer for a room to confine these men, but having been repeatedly put off, he added a memorandum of the circumstance to his monthly return, and showed it to the colonel. The latter begged of him to cancel it, the quarter-master was sent for, and the room was given up to the surgeon before the sun went down. All this was done without an angry word, and the colonel was very soon made to see the good effects of putting his men on hospital stoppages and low diet, instead of permitting them to stroll about the town, to enjoy a full meal, and to regale themselves in the evening with pipes and Nottingham ale.

This, Gentlemen, is comparing small things with great, but it is illustrative of a principle from which I would advise you never to depart; to make a concise and distinct statement to the superior authority, whether military or medical, to emit no uncertain sound, to have no paltering, nor to make any compromise with those throwing obstacles in the way of the public service.

It is not, however, with military men, that the difficulties of the department have heretofore generally arisen, but with the underlings in those numerous collateral offices which have so long been permitted to impair the energies and exhaust the strength of a War Department in this country. A man who will not hesitate to storm a breach, or to head a charge of cavalry, such as that of the light brigade at Balaklava, will think twice before he opposes the opinions, or impedes the operations of an intelligent and experienced surgeon. Nay, such a man will be the very first to listen to any respectful and reasonable suggestion touching the health of his men. If such things as I have cursorily noticed can be done by a regimental medical officer,—who, if he knows his duty, and chooses to do it, may be a very independent man,—if such things can be done by a regimental surgeon, what ought to be the influence of a man of energy, experience, and decision at the head of the department?

I have already hinted that the trammelling of the medical department has been a growing evil, although spoken of by many as something new.

The limited powers and want of independent action, has been more or less a standing and a just cause of complaint ever since I knew anything of the service; but in spite of this, we have often had the duties of the department carried on with success, and we have had men amongst us, more than one, who, if an independent action was not conceded to them, did not hesitate to take it.

Amongst these, I am tempted to mention a name which will probably be new to most of you—the name of my late friend Mr. Young—and I do this the more willingly, because he is little beholden to posthumous fame, in consequence of never, so far as I know, having written anything for publication. This gentleman, in his regimental days, was a predecessor of mine in the Royals, where his name was long held in respect, and he spent the evening of a long and laborious life in this neighbourhood, at Rosetta, near Peebles, where he had built himself a residence, and borrowed its name from the scene of his former labours in Egypt. He was at the head of the medical staff upon two memorable occasions, and it was said to his praise, that “the worst calamities of war had no place either amidst the swamps of Holland, or on the burning sands of Egypt.” And it was said some four-and-fifty years ago, with reference to his conduct, and to the point of independent action, that, “in what concerns the health of an army, the praise or blame must peculiarly and distinctly belong to the medical superintendent; because the events then, whether prosperous or adverse, must depend upon causes of which professional skill alone is competent to take cognizance. The hospitals, of course, must be just as much under the Inspector-General as the arrangements of the field are under the Commander-in-Chief, and consequently, any peculiarity of success in the recovery of the sick and wounded is as much to the appropriate praise of the former, as the wise array of a battle or a siege is to the distinct honour of the latter.”

Mr. Young, Gentlemen, was a man of the stamp of Larrey, to whom he was well known in Egypt, and who inquired most kindly for him, when he visited this city. He was a man who saw no obstacles in his way, who stuck at nothing for the benefit of the sick, and who suffered no inroad on the rights of his department. When chief of the staff in the West Indies, a young doctor was sent out to him as Physician to the forces, with the King's commission and an Oxford or Cambridge degree in his pocket, the only ones then qualifying for that rank. Mr. Young declined to receive him, telling him that he could not allow those gentlemen who had been toiling under him as staff and regimental surgeons to be superseded by one who had never before seen a sick soldier. The young man, seeing that there was no room for him in that quarter, requested the Inspector to give him an order on the paymaster for some money, and on the agent of transports to carry him home. The reply was, “I will not acknowledge you by any official act whatever.” But, said Mr. Young, I happen to have some money at my credit in the paymaster's books, and whatever you want I will most willingly give you.

The gentleman found his way back to England, and Mr. Young soon after followed. He was ordered to repair to the Medical Board, and there he found the physician-general and the surgeon-general (neither of whom had any previous service to lean upon), in great indignation at this insult to their authority, and the former remarked upon Mr. Young's courtesy to the physicians to the forces, to which he calmly replied, that if the thing was to do over again he would just do as he had done. The surgeon-general then showed his temper, and observed that they had not made up their minds whether they would not bring the whole proceeding before a court-martial, to which Mr. Young, taking up his hat, and making his bow, said, "the sooner the better." The court-martial, however, was no more heard of; they knew that he had the feeling of the service with him, and that he had Sir Ralph Abercromby at his back. I appealed for the truth of this anecdote to Mr. Young himself, stating it to him as I had heard it, and as I now repeat it to you. He quietly observed that it "was very near the truth."

This leads me naturally to say a word on the introduction of the "civil element" into the military hospitals. It will not be supposed that I who lived and practised so long in harmony with my professional brethren in this distinguished seat of medical erudition—who have now been so long an atom in this "civil element"—who, amongst those who have closed a brilliant career, have been often in consultation with such men as Gregory, Abercrombie, and Liston—who have had the honour to rank amongst my colleagues in the University, such men as Thomson and Charles Bell, will be found wanting in respect for the civil branch of my profession. The civil members of the profession have evinced a most generous spirit in the way in which they have espoused the cause of the assistant-surgeons of the Navy; and I am sure they will sympathize with those men who have been spending toilsome days and sleepless nights under canvas in the Crimea, and are now made the scapegoats for errors committed at home. It grieves me to think that these men should find themselves, at the close of a campaign, supplanted by others who have not borne the "burden and heat of the day." Could I believe that this was for the good of the public service, I would speedily be reconciled to it. But is it to be supposed, that men who have, like myself, been accustomed to see their hospitals broken up soon after midnight, to make a march of twelve or fifteen miles, and to have their hospitals again in operation by the time they sat down to breakfast, and this from day to day for weeks in succession—is it, I say, to be supposed that men conversant with such duties as this, are less competent to the organization of new hospitals than those who have passed perhaps an hour a day in the simple duty of prescription?

I have all along maintained that there never was a want in the army of the Crimea of men equal to the higher duties of the department; but instead of seeing those men promoted to a higher rank, which they have so well earned, and appointed to what would have been to many of them an easy

duty, they are superseded by men who, whatever may be their merits in other respects—and these I have no desire to question—have never hitherto had an opportunity of giving an opinion on the position, construction, or economy of an hospital—and all this at an increased expense to the nation. How far this is calculated to attract talent to the public service, to encourage merit, or to benefit the sick soldier, it is for the Government to judge.

It is quite clear that a sufficient number of hands (to use a seaman's phrase) could not be spared from the Crimea, to man these auxiliary hospitals, but, with the diminished numbers and improved health of our army in that quarter, occasion might have been found for the promotion of some half-dozen of staff-surgeons, to be placed at the head of them; and I make no doubt that many of the young gentlemen who have volunteered for the duties of those hospitals would have preferred serving under men of rank, standing, and experience in the army. What is it, I should be glad to know, that is required from the civil hospitals? is it those limited powers often imposed upon physicians and surgeons by a close-fisted treasurer? is it those delays and impediments to improvements occurring from the necessity of a reference to the governors? is it that vexatious interference on professional points sometimes exercised by a philosophic manager? or is it that divided and imperfect responsibility under which medical men have sometimes been enabled to shelter themselves when decidedly in the wrong?

The military hospitals, in my younger days, were looked to as patterns for imitation in the organization of similar establishments for the purposes of civil life. I have now had some experience of both, and I say advisedly, that although the military hospitals are not in all respects what they might be, there is, in these hospitals, much of that arrangement, promptitude, and self-reliance, which ought to characterize all military proceedings. The quantity of superfluous writing in the medical department has, I am glad to see, been well exposed by my friend Dr. Dumbreck, in his evidence before Mr. Roebuck's Committee, and I fear that this department has to answer for a large share of the £70,000 worth of stationery said to have been sent out with the army of the Crimea.

The absurd system of checks and counter-checks, so forcibly exposed by the late Secretary-at-War, would still seem to be in full operation. Of this I recollect a very ludicrous instance, and was in some degree a party to it, when a very young man. The hospital expenditure account was "returned for correction," and the surgeon, the hospital-sergeant, and myself, set our wits to work, and mustered all our joint stock of arithmetic to discover the error, but being unsuccessful, the account was sent back to the Medical Board, and was twice again "returned for correction." As if to make the thing more ridiculous, an orderly dragoon was kept galloping backwards and forwards between the head-quarters of the district and the village where we were quartered, with this precious despatch, and the

mighty error turned out to be "an ounce of oatmeal overcharged." Had the clerks in the Medical Board, who at that time checked the returns, condescended to mark, by a cross on the margin or otherwise, where the error lay, it would have saved a considerable loss of time and temper, to say nothing of the wear and tear of man and horse.

This, however, chiefly concerns the public; but there are some cases in which I fear the medical department has assisted in forging its own fetters. I should be glad to know what has become of all those portly folios which have been accumulating in our regimental hospitals for a long series of years, at a great expense to the nation, great labour to the surgeons, and little edification to the profession. It is no doubt an object of great importance, particularly when men are brought forward to be invalided, to have an authentic record to refer to, showing how often a man has been in hospital, and for what particular complaints; but surely all this might be accomplished without allotting a page or two of those huge folios to every man admitted, compelling the surgeon to spin his brains to give a graphic description of a sprained wrist, or an ulcerated leg, or to detail with equal prelixity the case of one man with a virulent gonorrhœa, and another with a malignant typhus fever.

I know no good that comes of this compulsory writing; but there is another description of writing which I should wish to see encouraged. I know not at this precise moment what are the regulations, or what is the practice of the French army, but I know, that from the medical officers of that army have emanated more than sixty volumes of the "*Recueil de Mémoires de Médecine de Chirurgie et de Pharmacie Militaires.*" This published under the authority, and at the expense of the Government, and containing many valuable papers on subjects all important to the health of the troops. In this, I think we would do well to imitate them. In addition to all other professional competitions open to the military surgeons as well as to others, I should like to see a competition instituted within the department itself. Who will show himself most conversant with the diseases of soldiers and seamen, and with those injuries to which they are exposed in the battle-field, and on the ship's deck? Who will give us the best papers on the medical topography of our many foreign stations, and on the best sites for camps, cantonments, barracks, and hospitals at home and abroad? Who, in short, will evince the most perfect knowledge of all the *juvantia et laedantia* of a military life? A selection of such papers by an impartial committee, and published by the Government, would give encouragement to the department, and health to the army.

(*To be continued.*)

Travel.

SINGAPORE—THE BRIGHTER SIDE.

By MAJOR H. C. HARRISON, D.S.O.

General Staff.

IN May, 1924, there appeared in this Journal an article entitled "Singapore." It contained so much of value to a married officer about to join the station that it is a pity that the author, acting upon impulse, put pen to paper after a very few months in Singapore, with the result that many misleading statements appear in the article.

The same headings are used as in the original article.

COST OF LIVING.

Actually this is about the same as in England. All the really good meat comes from the cold storage; green and other vegetables are plentiful; lettuce and cucumber should not be eaten uncooked unless something is known about the gardens whence they come.

The point is that, so far as the average married officer is concerned the *standard* of living is somewhat higher than at home. This is doubtless due to the great wealth of the country and to the normal prosperous condition of the British non-Service people out here; just now there is a temporary financial depression. However, people live well, and so the standard is to a certain extent forced upon the floating population, i.e., upon the garrison.

SERVANTS.

Domestic service has been adopted as a metier by the Chinese of Hainam, a large island to the south-west of Hong-Kong. The Chinese servant is efficient, very clean, very intelligent, and when treated well, absolutely reliable. As in other parts of the world he does not accept domestic service from philanthropic principles, and he is out to make his living by it; if he is reasonably well paid, he frequently becomes absolutely devoted to his employer; his weakness is to act as a "middle-man" in the purchase of food and things like boot-polish, and to make a middleman's profit. This he does by purchasing the boot-polish at a Chinese shop. The same article might be bought by his employer at one of the European shops, but a higher price would be charged because European assistants are employed. Why blame the boy for a process which is directly the result of European profiteering instincts?

If the "boys" are cut down to the last dollar, subjected to intense supervision, and treated without consideration, they become discontented, work badly, and are dismissed. Such employers get a bad name amongst

the "boys," who will not accept service under such conditions. The employer finds himself liable to be boycotted.

Many employers, particularly amongst the "floating population," have a contract with the cook. An excellent contract can be secured for three dollars (7s.) per head per day; this includes all food, ice, fruit, boot-polish, floor polish, fuel for bath water, everything except drinks.

It is a good thing to see that the cook gets his meat from the main cold storage, and his green vegetables from a reliable source. Under the contract system there is no question of paying rickshaw fares for shopping.

Whatever system is adopted it is important to note that the servants' food is not a charge upon the employer. A marked saving on home conditions this. The "boys" cannot steal their food from their employer, they eat two meals a day, each consisting almost entirely of rice. Actually each boy has a "contract" with the cook.

The author of the article gave in tabular form the servants and wages required for a spacious non-military residence. Nobody else in the garrison lives in anything but an army house or bungalow. There, whether senior or junior, they usually employ:—

				Dollars
One head boy	..	..	..	30
„ young assistant	..	..	..	16
„ cook	..	..	..	25
„ Tukang ayer	..	..	..	18
Total				89

say £10 per month;

or 150 per cent less than indicated in the article.

For children an amah is required. Officers usually share a gardener.

HOUSES.

It is unfortunate that misleading information regarding so important a matter as the married officers' quarters on the station should have been given. At the time the article was written not only were five new quarters being built, but the money had been voted for rebuilding all existing married quarters on up-to-date lines.

When this new building is complete there will be a sufficient number of modest but adequate residences, furnished with electric light and fans. The model selected is based upon accumulated experience of the Government civil engineers and affords the maximum coolness obtainable. Wide side verandas are readily convertible into dressing rooms. White-tiled bathrooms of the approved type are provided; the sanitary arrangements alone remain primitive; this fault cannot be remedied until the municipal authorities in Singapore revise the whole of the town's sanitation.

The present writer now lives in one of the "grotesquely small . . . doll's houses" described; he has previously lived in the General Officer Commanding's house, and in one of the most modern houses in Singapore. He prefers the "doll's house": it is cooler and more cleverly constructed, and the house is the envy of many civilians in Singapore.

HOTELS.

The writer lived in the foremost hotel in Singapore for some months; special terms are offered to "residents" in the hotel, and the management afford special facilities to members of either service to be included in the limited accommodation allotted to "residents."

For a period exceeding three months, a bed-sitting room and bathroom in the hotel, with all meals, service, fans, etc., included, can be secured for under £1 per head per day.

SPORTS.

The Cricket Club and the many excellent tennis clubs are all that can be required. On no account should a tennis racket be brought out from Europe: it is far better to buy in the Island a racket specially strung to meet the exigencies of the Equator.

On hardly any station can a beginner at polo gain his experience at less expense than at Singapore, while there are many tournaments for the more experienced players.

Sailing—normally a "rich man's pastime"—may be indulged in at Singapore by men of moderate means; the club-house, though of modest design, serves its purpose without bringing unnecessary expense upon the members.

For the majority of men, 4 p.m. to 6 p.m. becomes a sacred period to be devoted to exercise: if rain prevents tennis, there is a readily accessible Garrison Golf Course which no amount of rain can flood.

GENERAL.

A marked feature of the station is the extreme hospitality and kindness shown to officers of the Garrison and their families by all members of the civil community.

Many of these realize that the majority of officers are on the station for so short a time that improvisation in order to secure comfort is more economical than elaborate outlay. The natural disadvantage at which an officer finds himself is readily recognized and every effort is made by those residents, whose establishments are of a far more permanent nature, to make the sojourner comfortable.

In conclusion, let it be realized that the lot of the officer—married or single—at Singapore is no worse, if not considerably better, than at many other foreign stations.

Plans for a hill station in Malaya are already in existence, and its existence in the course of a few years may be taken for granted.

The present lack of a hill station, the primitive sanitary arrangements, and the unsuitability of the station for children over 7 years of age, are the only drawbacks which appeal to the normal mind. Of these, the two first named will be remedied within a very short time.

To many officers and their families the advantages of life at Singapore outweigh the disadvantages.

Sport.

THE BAHMIN'S DAY.

BY CAPTAIN T. O. THOMPSON.

Royal Army Medical Corps.

"YOU will proceed forthwith to Cannanore and report on the milk supply for families."

So ran the telephone message to the "laboratory."

Here was the longed-for opportunity, for which we had been waiting. Previous duty-trips to Cannanore had shown that there were considerable possibilities in the way of fishing at and near Cannanore; both sea and estuary fishing.

The latter was now the attraction for us, rather than the former. The former meant either fishing out on the rocks, or from a boat.

Previous experience of the rock fishing had shown that there was infinite variety, but not much in the way of size. The variety ranged from small green crabs to sea-snakes, three foot in length and said to be highly poisonous.

Estuary fishing meant the possibility of bahmin. Thomas in his book "The Rod in India," which every fisherman in the South of India should have or should read, says that the bahmin is the best tackle breaker in the world. The bahmin does not grow to a large size, like the mahseer or the nair-fish, not more than twenty pounds, but his habits are such that, where fished for with rod and line, he becomes the tackle breaker *par excellence*. His habits resemble those of the salmon, in that he lives in the sea and at certain seasons runs up the rivers. In fact, he is known and sold as the Indian salmon.

In the estuaries, the spots to find him are wherever the current is fastest and a whirl of water is produced. Here he appears to lie, deep down behind some rock or pile, in wait for the shoals of small fry, particularly small grey mullet, which scurry past over his head.

In some respects he appears to be much like that magnificent fish, the Thames trout, which feeds at regular times, surging up from some favourite corner or behind some old post or stone, and charging into the fleeing leaping shoals of small fry.

Like the trout also, he appears to believe in having a good square meal. One seven-pound trout, which we caught near Oxford, on being landed coughed up a solid mass of two large handfuls of small fish which had evidently been a portion of his lunch.

The bahmin appears to be able, however, to get four meals a day. He lies for preference in the estuaries of the west coast rivers, behind old posts and piles, and feeds when the tide is running strong. He feeds, therefore, twice on each tide, when it is running up and when it is running out. His

best feed is said to be at the falling morning tide, and it is during the one to two hours, when the tide is running, that it becomes evident that His Excellency the bahmin is feeding.

This is the time to get him, and when you have got him, there is a six-to eight-knot tide running like a millrace to get him out of. Here, then, is where the tackle-breaking propensities come in; a strongly flowing stream, a mass of piles, posts, rocks, old rails, and other engineers' debris and a frenzied bahmin threading the line skilfully through the lot.

This should be enough to show why the choice lay with bahmin, in preference to crabs and sea snakes.

On receipt of the message, preparations for the possible encounter were eagerly carried out; a new split cane salmon rod recently purchased was got out, fondled, tried on the lawn, and put ready together with 100 yards of Farlow's best waterproofed silk spinning line; traces got ready, both of gut and fine piano wire; hooks, wobblers, crocodiles, spoons, etc., were all carefully examined and put ready.

Also, alack and alas! pride going before the fall suggested a supply of formalin, wherewith to preserve the head of the future captive, and a bottle of this was added; this, as it will be seen, proved the cause of disaster.

The boy, having been sent off by train, on the Nilgherri railway, with the baggage, we, ourselves, proceeded on the journey down the hill to Metapallayam, and the mail train for Cannanore, by the Ghaut Road by motor cycle, carrying the fishing tackle in the side car.

Alas! a bumpy bit out on the plain near the station caused a broken formalin bottle, a horrid smell of formalin, and a wetting of some of the tackle with formalin, with results to be described later.

It is a wonderful bit of work that Ghaut road, a beautifully kept, smooth, motoring road dropping from 6,000 ft. to 800 ft. in 16 miles, and with 167 real corners in that distance; from a temperate even chilly English type of climate to a hot, steamy, sub-tropical atmosphere; from open, rolling and rocky hills through all types of vegetation to dense steaming bamboo jungle and areka nut palms; in fact from English moorland to southern Indian plains.

A road sometimes empty from end to end; often disturbed by some wildly driven modern motor in the hands of the unreliable native of the country; and nearly always blocked for several hundreds of yards in some portion of its length by convoys of slow-moving prehistoric bile carts.

Oh, those bile carts! invariably on the wrong side of the road, the alleged driver soundly asleep on the top, and the sleek old biles patiently plodding on day after day until finally they die in the shafts. (Note.—We have actually seen such an occurrence.)

Many trips have we done up and down that road, by day and by night, in hot weather and in cold, in winter sunshine and monsoon storm and yet it always remains fascinating, full of charm and seldom the same. Many

a time have we run down the Ghaut and back of an afternoon just for the pleasure of the contrasts.

However, let us leave the fascinating road and return to the subject of the bahmin day. Dinner at the well run refreshment room at Metapallayam, was followed by the short journey to Podanur. Here a change and wait for the Mangalore train is usually necessary. The night passed comfortably running through the Palghat gap, that sixteen-mile break in the western hills of Southern India, through the Moplah country to Calicut on the coast. Here an early breakfast enabled us to be ready for the day's work as soon as we should arrive at Cannanore.

The journey from Calicut to Cannanore is only some forty miles, but we do it leisurely in the train and have plenty of time to see the country.

On our left is the intensely blue tropical sea seen at intervals. On the right the typical clean fertile country of the Moplah backed in the distance by the blue hills of the Nilgherries and Wynaad. Clean and smiling are adjectives which suit the Moplah and his country under ordinary circumstances. The villages are all of properly built houses of laterite brick with decent roofs, often of Mangalore tiles, each in its own garden-compound, well raised above the level of the earth and often two storied.

As a whole they are extraordinarily well kept, clean and prosperous looking.

The Moplah himself is a fine looking man, clean, well-built and hard-working. Both the Moplah and his house are a marked contrast to those of neighbouring parts of Southern India. If there is a job to be done in that part of the country it is the Moplah who does it; the fat Hindoo money-lender and the oily baboo are the bloodsuckers of the country.

Just after leaving Calicut we passed the Garrison area with its well built barracks, with broad deep verandas and solid walls, perched on that curious conical lump of laterite called West Hill. Then on through the typical west coast country into acres of well kept coconut palms, the brilliant green of paddy fields, the dark red of the laterite hills and the broad estuaries of many rivers.

We passed Mahé, that extraordinary piece of France wedged into British India, where even the native children patter French and the tricolour floats over the coastal shipping lying in the river. On a much later occasion we did the journey through this piece of country by car, and on coming to Mahé we found we had to make a thirty mile detour simply because the wooden bridge, the only bridge, was slightly damaged and had been so for seven months without being mended.

At Telecherry we crossed the three estuaries and noted the road bridges, which Thomas in his book recommends as being good fishing spots, we noted that the tide was high and therefore on the morrow an outgoing midday tide would be available.

And so we came to Cannanore and the day's work.

The day's work finished in time to get an evening bathe on that beautiful strip of sand which forms the north beach. That bit of coast compares

in some respects with the Riviera. The deep blue sea and less blue sky, the blazing white of the immense stretch of sand, the vivid green of palm trees, the distant blue hills and the deep red of the laterite cliffs and rocks.

Back to the hotel for a good dinner and early to bed in pleasurable anticipation of the morrow. Cannanore is one of the few places where hotel living is decent and yet cheap even now.

Up betimes, with the earliest light and a cold wind from the hills coming in at the window, to get the train at six o'clock to Palayangadi. This is a couple of stations up the line towards Mangalore and the railway crosses a broad estuary on some sixteen stone piers where the river narrows somewhat. It was here we intended to visit His Excellency the bahmin.

Arriving at the station we sent for a boatman and walked back the two hundred yards to the river to examine the prospects. The railway bridge is high and the only way of crossing on foot is by a single plank track lain on the sleepers down the middle of the lines. The station and village lie on the north bank and there is a road for ferry carts, etc., some 150 yards above the bridge at the village where the river commences a bend and broadens out into a bay on the south bank. The banks are chiefly of mud but stone lined on either side of the bridge. The tide was rising and nearly full.

The boatmen then arrived in their bark which was the typical west coast river dug-out made from a single tree trunk hollowed out, pointed at both ends and leaking. He had had the forethought to bring a supply of small grey mullet as bait, but said that it was no good trying until the tide was running, and that the best time would be between eleven and twelve noon.

So we had to sit down to wait patiently for a while. Breakfast, a study of the river and the excitement of seeing the villagers' method of landing a fish passed the time away. The first was comforting and the second showed that spinning from the bank would cover the two end archways on either side with risk of losing tackle easily, and the third was a really interesting sight.

A very elementary knowledge of Urdu on either side plus a few words of English, plus a vehement and well illustrated flow of fluent Malayalam, plus the use of one's own eyes gave the details of this fishing.

On a rising tide a large hook some six to ten inches in length is tied on a length of stout rope, baited with a piece of decaying fish or meat, and hurled into the midst of the river, where it is allowed to sink to the bottom.

The nearer end is hitched on to a convenient palm tree. About the top of the tide the bait is usually taken, preferably by a Nair fish. When the tree shakes something is evidently biting on the line and a watchful youngster calls the heavily sleeping fisherman and his stalwart sons. Together they apply their weight to the line and haul their prize out by sheer force, taking a hitch round the tree for rest if required.

On this occasion the catch looked about six feet long, but they said it was not a very big one and showed a scale from a big one which was as big as one's whole hand.

By now the tide was beginning to run out pretty freely and we decided to start although the boatman said the bahmin was not moving yet and that there would be no doubt about it when they did start.

We decided to use a wobbler, which had been effective for Thames trout and to bait it with a five-inch grey mullet, and to spin from the bank until the bahmin got on the move.

The tackle was soon ready with the new best waterproofed spinning line all secure and running smoothly. After a few casts we soon regained the hang of the methods of casting (not with a Silex reel, which all real fishermen employ, *vide* the catalogues), and got the wobbler bait turning over nicely in the current. The motion of a wobbler bait gives an appearance much more like an injured fish than does the straight spin of other swivel tackle and in our experience seems to produce the most attractive form of bait.

After half an hour of trying the most likely looking places, just as the bait was nearly fully wound in, a long grey green shadow suddenly appeared behind the bait.

However the alarming vision of several human beings glaring closely down on it, was too much for it and away it went with a swish.

The tide was beginning to run fast now. We had just turned round in preparation to make another cast and were facing away from the water, when there came a sound as though one of the over-excited youths standing near had fallen in.

We turned in astonishment to see just beneath us a boiling swirl and a splash of spray, and the boatmen simultaneously ejaculated "bahmin"!

And now every two or three minutes, all along the line of the arches of the bridge, but always on the upstream side, there came this thrilling, booming splash, the flash of spray, the scurrying shoals of small-fry scuttering along the surface, and the deep gurgling swirl as the bahmin rose, chased and grabbed his prey, and retired to his lair once more. At every splash the boatman invariably ejaculated "bahmin" and after a time this repeated ejaculation of "bahmin" began to become quite monotonous.

We now embarked in the dug-out and the boatmen endeavoured to row to and fro across the river on the upstream side of the bridge at such a distance that casting would cover the area where the bahmin were coming up.

This was no mean feat, the dug-out was not what one would call a handy craft at the best of times, the paddles were clumsy and heavy, and the tide was ripping through the piers with foam-fringed edges. However, we got going in the proper place and a good cast covered one of the central arches.

Woorrooish! up came the spray, a swirl and we struck. Got him! yes for the moment perhaps we were in him, but what about getting him out. Away he shot above the next pier for the next archway with the rod bending like a bow and the line fizzing as it cut through the water. How-

ever he thought better of it and hesitated. The boatmen meanwhile were yelling and paddling like furies to get away from the bridge up to the bend 150 yards up river where a big shallow bay was formed. On they struggled against the fierce tide, while we simply held on to the fish and solemnly towed him upstream.

However, a little of that was quite enough for our friend, and the boat had hardly begun to reach easier water when he really got going, but here was open water, a reduced current and no masses of rocks or piles to play with.

Away he went across the stream, the reel screeching as the whole of the 100 yards of waterproofed line shot out and the silk backing came into play, 120 yards he went and then as suddenly commenced to race towards the boat. Halfway he turned and began to bore steadily upstream. Here was a chance and the boatmen made for the shallow bay, and now we commenced to reel him in. In he came slowly until some forty yards away he suddenly found himself getting into shallow water. He turned for the deep water and the bridge, felt the strain of the line and jerked hard. Ping! the line snapped and trailed limply from a straightened rod. Away went Mr. Bahmin and slowly and sadly we reeled in the line. That poor old line! we tested it with our hands and it broke piece by piece like 100 cotton instead of the best plaited silk.

The fierce sun, plus the salt water, plus the formalin spilt over it had been too much for it, the waterproofing was peeling off and the substance rotten in many places.

Here indeed was a bad bit of luck!

However, down by the bridge the booming splashes were still going on and we got out an old and trusted plain untreated spinning line and rigged up a fresh set of tackle.

Back we went to the bridge and the boatmen commenced to row across once more, but the extreme rip of the tide had lessened. Up and down we went, casting towards the arches but not happening to be within range of a feeding fish at the right moment; back we went again to the other side, turned again and had nearly reached the centre when there was a great swirling splash and the line whizzed out before we had time to strike or move. Down he went, deep down towards the base of one of the piers.

Deep down was where we did not want him because that was where the danger of piles and rocks lay, so we put on some pressure and he stopped, waited a second and was away like a flash through the arch racing for the lower part of the river.

Were we to follow or not? The tide was still running hard and there were several nasty looking swirls showing in the middle of the archway, and the boatmen evidently did not like the look of it. Twenty, thirty, forty yards he went and then stopped, and for some reason best known to himself proceeded to come back straight on his tracks.

Back he came to the centre of the arch and there despite all the strain

possible proceeded to come to rest behind some obstruction which caused one of those ugly swirls on the surface, and then alas! the line or tackle touched the obstruction.

However, we could feel him still there and kept up the strain. Apparently it was too much for him and out he came again boring upstream and by good luck the tackle swung clear too. And now the boatmen proceeded to row for the bay upstream and we towed the fish along for some 100 yards upstream and got him clear of the danger of the bridge.

He now recovered himself and proceeded to give a talented display. Three times he raced away with the reel whirring, three times he stopped and was slowly wound in. Then he bored for the bottom and once shot out like a silver bar seventy-five yards away. Finally he began to give in and the boatmen made for the shallow bay. Here we began to reel him in until he began to feel the shallowing water and put up extreme resistance.

There we seemed to stick, the bahmin struggling, the rod like a bow, the line rigid, and the fool trying to reel it in. "Pull tighter, sahib, pull tighter," said the boatmen accustomed to their own lines composed of young rope; so the sahib, like the fool that he was, pulled tighter. A splash! out flashed the bahmin again and crashed back on the line. Ping! a slackened rod once more trailed a limp line while the fool sahib reeled it in.

Examination showed that a new steel wire trace had snapped clean; not at a place where there had been any twist made but at a plain straight piece. Possibly the wire had got kinked when caught in the obstruction, possibly a loop and kink had formed when the bahmin leaped and turned over on the tackle, anyhow the strain had been much heavier than we ever applied to any salmon.

And now the tide was slackening down and though one or two bahmin were still feeding, we tried again without any success, and in half an hour the feed was over and the tide slack. Regretfully we put away the tackle and prepared to return to the station. It was now we found that fishing in an open boat in the blazing October sun in that steamy atmosphere was thirsty work, and when presented with a freshly cut coconut by one of the boatmen, realized for the first time what a wonderful drink the fresh coconut can provide, a clear ice cold liquid in the middle of a fierce tropical sun.

Tea and a refreshing shower bath in the train made us feel far from dissatisfied, and we commenced the return journey for Wellington fully determined to return again as soon as duty and the powers that were would allow a few days' leave.

And so ended a great day, a day of excitement, pleasure and experience, a day of our first encounter with the bahmin, and those who have borne with us so far will, we think, agree that the heading of this sketch has been fulfilled it had been the bahmin's day.

Current Literature.

A Study of the Tumbu fly, *Cordylobia anthropophaga* Grünberg in Sierra Leone. B. Blacklock and M. G. Thompson (*Annals of Tropical Medicine and Parasitology*, vol. xvii, No. 4).—The site favoured for oviposition is dry sand previously contaminated with excreta, but if hard pressed flies will lay their eggs on cloth and other materials. The eggs are never deposited on the skin or hair.

In the process of egg-laying in sand, the female digs a small cavity into which the egg is extruded. With the hind legs she scrapes a little sand over the eggs and smoothes down the surface. She then moves a few steps and repeats the whole process. As she may lay as many as 300 eggs in a batch, a small area may be very thickly sown with eggs. The eggs usually hatch within four days.

The larvæ remain where they hatch out just below the surface of the sand, and when quiet they are difficult to detect even with a hand lens. When disturbed by vibration, or by touching the sand, or if a vessel of hot water is brought near them, the larvæ make their way rapidly to the surface where they fix themselves by the posterior end, the rest of the body being raised in the air and waved actively about seeking for something to which to attach themselves. They adhere at once to any object touching them and quickly crawl up on it.

Left in sand without food, larvæ remain alive usually for about nine days, rarely for as long as fifteen. Larvæ which attached themselves to cloth laid on the surface of the sand remained alive for nine days. On the skin of a suitable animal the larva crawls to the nearest depression in the skin and proceeds to bore in. The time taken to conceal itself varies with the resistance of the skin. Larvæ placed on the shaved abdomen of the rat penetrated the skin in from twenty-five seconds to one minute.

Two moults take place in the tissues, and the mature larva leaves the animal host usually about the eighth day, burying itself in sand, etc., where pupation takes place. In human beings the larva takes a longer time to mature.

At room temperature in February the pupal stage lasted about ten days and is prolonged by cold.

The rat appears to be the main natural reservoir of the infection, though dogs, monkeys, cats, squirrels, guinea-pigs, etc., may serve as hosts. Heavy infections may result in the death of the host. In East Africa, Koch investigated an epizootic which was killing wild rats, and which was at first suspected to be plague. On investigation the deaths of these animals proved to be due to infection with *Cordylobia* larvæ.

Treatment.—Any scab is removed and a film of liquid paraffin placed over the opening in the skin, and gradually thickened drop by drop.

In its efforts to get air the larva lubricates itself and the walls of the cavity. The superfluous paraffin is wiped off and the larva expelled by pressure of the thumbs. Simple expression is effective but often painful. In the late stages removal by fine forceps is easy. The larvæ must be destroyed after removal.

Prophylaxis.—Adult *Cordylobia* should be looked for daily in houses and destroyed. During the sunny hours of the day they may be found on ceilings of rooms and verandas. Latrines should be fly-proof. Sand and soil used for the latrines should be heated in a kerosene tin for some time before being placed in the latrine box. Weekly examinations of domestic animals for larvæ, any found being expressed or killed.

Rats should be eradicated as far as possible from houses and compounds. Those captured should be destroyed by burning before the larvæ leave the hosts.

It is advisable to have clothes washed in the compound and, after ironing, kept in drawers or covered boxes.

The Treatment of Kala-azar by Meta-chlor-para-acetyl-amino-phenyl Stibiate of Sodium (von Heyden 471). By L. E. Napier (*Indian Medical Gazette*, lxviii, 12, p. 578).—This antimony compound is a product of the firm of von Heyden of Dresden. It combines low toxicity with high parasitotropic value. In the cases under review the compound was given intravenously in solutions of one to five per cent. The dry powder was weighed and dissolved in ten cubic centimetres of distilled water. 0·4 gramme may be regarded as the maximum dose for an adult. The course recommended for ordinary cases is an initial injection of 0·2 gramme and subsequent doses of 0·3 gramme on alternate days, the course being completed in nineteen days.

Consideration of the Results.—The shortening of the time occupied by the treatment from two months, which was the minimum time occupied by the usual antimony tartrate course, to three weeks has many obvious advantages, and the reduction of the number of injections from thirty to ten will effect a saving of labour which will more than compensate for the additional cost of the compound.

One of the most striking facts about this treatment is the rapid reduction of the temperature. In cases that are running a high temperature this is reduced almost immediately to the 100° line, and from this to the final disappearance of the fever is usually only a matter of a few days. In these cases the average number of injections to the final disappearance of the fever was 5·5, whereas in a recently analysed series of seventy cases which were treated by the usual course with antimony tartrate and were eventually completely cured, the number was fifteen.

Another important point is the rapid reduction of the spleen. This usually pleases the patient and should be a great help to the doctor in general practice, where pleasing the patient is half the battle.

Lung complications, from severe coughing to broncho-pneumonia, which are such a distressing and often disastrous accompaniment of treatment with the antimony tartrates, do not seem to occur.

The reason for this seems obvious. The tartrates form an acid solution. When this comes in contact with the blood a fine precipitate of oxide separates. This oxide is caught in the lung capillaries, causes the coughing, and quite possibly forms the focus which determines the broncho-pneumonia. This aromatic compound which we are using makes a neutral solution and no precipitate separates when it is mixed with the blood.

It can be claimed for meta-chlor-para-acetyl-amino-phenyl stibiate of sodium that it is a definite compound, that it will therefore not vary in its composition, that there is no great difficulty in preparing it, and that it does not undergo any change in the Indian climate. We hope we shall soon be able to add to this list of advantages, that it has been placed on the market in India at a reasonable price.

Paraffinoma of the Vas Deferens. Leigh F. Watson (*Journal of the American Medical Association*, 1924, lxxxii, June 14, pp. 1935-1936).—The author reports an unusual complication following the paraffin injection of an inguinal hernia by a charlatan. The hernia promptly recurred and the cord and testicle on the side treated became swollen, painful and tender on pressure. At operation paraffin masses were removed from the internal oblique muscle, the conjoined tendon, and the vas deferens. The vas was occluded and it was necessary to resect it and anastomose the ends.

Because of the high percentage of recurrence following operations for "paraffin hernia" the regular Bassini operation was combined with the author's method of *lateral displacement of the cord*. With the cord displaced on to the internal oblique, half inch to the inner side of the deep suture line, the overlapped fascial flaps were securely stitched to the deep suture line to reinforce the weak spots, the usual points of recurrence—the internal ring, the lower end of the incision over the pubic bone, and the line of deep sutures.

The serious accidents that sometimes follow paraffin injections of hernia are: Gangrene of the skin, injection of cord structures, wounding of intestine, appendix or bladder with the needle, injection into blood-vessels, followed by pulmonary or cerebral embolism or sudden blindness from plugging of the artery of the retina, and occlusion of the iliac or femoral artery, with gangrene of the extremity necessitating amputation.

Jack-knife position after Hernia Operations. Leigh F. Watson (*Annals of Surgery*, August, 1924, lxxx, pp. 239-241).—The posture of the patient after an operation for hernia is usually neglected. If surgeons realized that they could reduce their recurrences materially, besides adding to the comfort of their patients, the jack-knife position would become a matter of routine for inguinal, femoral, umbilical and ventral hernias which presented difficulties in closing the fascial layers.

In inguinal hernia operations the best exposure is obtained by keeping the thigh extended until the deep sutures are ready to be tied, when it should be elevated, adducted and rotated inward. This reduces the distance between Poupart's ligament, the internal oblique and conjoint tendon from 25 to 50 per cent, depending on the size of the opening, the variety of hernia and the development of the muscles. After the patient is returned to bed his knees and shoulders should be elevated 25 to 45 degrees by means of pillows and a back rest. This position takes the strain off the stitches during the process of repair, permits a broad firm union of fascial flaps, and reduces the percentage of recurrences. The jack-knife posture should be maintained as long as the patient stays in bed.

Hernial Tuberculosis. Leigh F. Watson (*International Clinics*, 1923, vol. 1, s. 33, pp. 230-235).—The diagnosis of hernial tuberculosis is seldom made except at operation unless lesions exist elsewhere, such as in the abdominal viscera, peritoneum, genital organs, spine, bones, joints, lungs or meninges. The outlook is ordinarily grave because the patient often dies from the primary lesion. In children a congenital tuberculous hydrocele is often mistaken for a simple hydrocele. If the tuberculous hernial contents are thoroughly exposed to the air, improvement generally follows and sometimes healing of the local condition. Peritoneal tuberculosis is nearly always present also and should be dealt with through a second incision. In addition to the operative treatment, the usual measures employed to combat tuberculosis are necessary.

Prevention of Post-Operative Hernia. Leigh F. Watson (*Northwest Medicine*, April, 1924).—A muscle-splitting incision should be used when possible. In long incisions muscle fibres must not be sacrificed needlessly, and the motor nerves must be saved. The fascia is the strongest structure in the abdominal wall and it is very essential to close it properly. It is frequently under tension and unites more slowly than muscle tissue; for this reason it is necessary to overlap each layer separately. When closure under tension is unavoidable, the patient's shoulders should be kept in a semi-reclining position and the knees elevated on pillows (the "jack-knife" position) for a week after operation. Tension or stay-sutures are valuable to prevent strain on the fascia stitches. A gain in weight after operation, especially in obese subjects, should be avoided because it increases intra-abdominal tension and weakens the abdominal wall. The use of an elastic belt checks the tendency to rapid accumulation of fat.

Reviews.

MODERN METHODS IN THE DIAGNOSIS AND TREATMENT OF GLYCOSURIA AND DIABETES. By Hugh Maclean, M.D., D.Sc. London: Constable and Co., Ltd. 1924. Pp. xi + 191. Second edition. Price 12s. net.

A second edition of this monograph was a natural sequel to the introduction of insulin and there is no doubt that it will be welcomed by the profession as giving a short and concise account of the treatment of diabetes by means of insulin.

In the case of a new method of treatment it is only with the lapse of time that its advantages and limitations can be fully appreciated, but the experience already gained by Professor Maclean warrants a certain dogmatism in the laying down of a line of treatment. By carefully studying the methods and suggestions of the author the general practitioner will, to a very large extent, find the answer to that difficult problem—how to administer insulin treatment without frequent blood-sugar examinations.

Since the book was written the price of insulin has still further been reduced and the financial aspect of the treatment has been considerably eased.

A SIMPLE TREATMENT FOR TUBERCULOSIS. By Owen F. Paget, M.D. With Introduction by C. J. George Adami, M.D., F.R.S., and Prefatory Remarks by W. P. Birmingham, B.A., M.D. London: Constable and Co. Pp. xvii + 79.

This booklet explains the author's method of attempting to establish an immunity to tuberculosis by insufflation of dried tubercle bacilli. He employs crusted tablets of "tuberculin B.E." (Parke, Davis and Co.) in doses ranging from $\frac{1}{100}$ to $\frac{1}{10}$ milligramme according to the severity and duration of the case. He states "the number of cases of tuberculosis which have passed through my hands since the commencement of my investigations probably reaches one thousand. The last series, on which the dosage given is founded, consisted of 500 cases of tuberculosis and suspected tuberculosis, which were under my care when serving with the Australian Forces. Every patient improved under treatment, and no patient refused treatment."

Professor Adami's introduction explains the scientific basis of this treatment, which he considers to be well founded and worthy of further trial.

ANGINA PECTORIS. By Sir James Mackenzie, M.D., F.R.S., etc. Oxford Medical Publications. London: Henry Frowde, and Hodder and Stoughton. 1923. Pp. xvi + 253. Price 30s.

As might be expected, the subject matter of this book bears the obvious stamp of years of closely reasoned thought on the part of a careful clinical investigation.

Sir James Mackenzie's views on allied problems in cardiology are well

known, and those expressed in the volume under review must arrest the attention of all who are interested in the difficult problems concerned with the clinical entity known as angina pectoris. It should fill a long-felt want.

Apart from the pathological problems dealt with, much can be learned of recent views of normal cardiac physiology and the question of the production of visceral pain in general.

The author defines angina pectoris "as a condition in which a series of symptoms are produced by the heart, of which pain is the most prominent." His main theme is that such pain is the cry of exhausted heart muscle called upon to work under conditions of deficient nutrition, as by diseased conditions of the coronary arteries.

It is perhaps a pity that other well-known views on the pathology and causation of this distressing complaint are not alluded to and discussed in the light of the author's own clear thought. Presumably his views are to him crystalline in their clarity, and he refuses to cloud the issue with theoretical considerations of a diverse tendency.

The chapter on treatment though short is adequate. It sounds a much needed note of warning against the all too common practice of using cardiac tonics, etc., in a purely empirical and uncomprehending fashion. The 160 cases cited are helpful to the understanding of the author's contentions.

Finally, a tribute must be paid to the publishers' art. This volume fully maintains the high standard set in previous Oxford Medical Publications. The type and spacing are excellent. The diagrams and tracings are clear and the three full-page illustrations of post-mortem specimens of the heart in angina pectoris do much to point the moral and adorn the table.

R. E. T.

INDEX OF TREATMENT. By various writers. Eighth Edition. Edited by Robert Hutchison, M.D., F.R.C.P., and James Sherren, C.B.E., F.R.C.S. Pp. xviii + 1021. Bristol: John Wright and Sons, Ltd. 1921. Price 48s. net.

In this new edition the whole book has been revised thoroughly so as to bring it abreast of the latest knowledge.

The articles on burns, diabetes, electro-therapy, hysteria, mental diseases, neurasthenia, and rabies have been entirely rewritten.

New articles have been inserted dealing with encephalitis, kala-azar, snake bite, transfusion, the surgical treatment of constipation and other subjects. Nothing new, however, has been added to what appeared in the original edition on influenza and broncho-pneumonia, and in the consideration of asthma no mention is made of the cutaneous tests for hypersensitiveness to proteins and treatment by desensitization.

The volume is well illustrated and the type is plain and easily read. The number of contributors is large and many of them have an international reputation, as for example, Sir Clifford Allbutt, Sir John Rose Bradford, Sir Byron Bramwell, Sir Robert Jones, Lockhart-Mummery and others of equally great eminence.

Most of the prescriptions are given in detail, a point of great importance to the practitioner.

This is a book that will be of very great value to anyone who wishes to have by him a volume giving him the important treatment of all conditions, arranged alphabetically, and so easily consulted.

A. G. B.

THE TREATMENT OF FRACTURES IN GENERAL PRACTICE. By G. Max Page, D.S.O., M.S., F.R.C.S., and W. Rowley Bristow, M.B., B.S., F.R.C.S. Henry Frowde, and Hodder and Stoughton. 1923. Pp. xi + 239. Price 12s. 6d. net.

The aim of this volume, according to its preface, has been to provide a manual which deals simply and clearly with this subject, one which will be a ready work of reference for the practitioner, the house surgeon, or the student.

The whole tone of the book is practical. It describes in detail the methods of treatment that can be carried out without the use of elaborate apparatus, by those who have not had special experience. It is full of illustrations, clearly written and concise; the joint authors have succeeded in producing a work that is just what the practitioner wants.

M. B. H. R.

INSULIN IN GENERAL PRACTICE. By A. Clarke Begg, O.B.E., M.D., Ch.B.Edin., M.B.Lond. W. Heinemann (Medical Books), Ltd., London, W.C. 2. Pp. 130. Price 5s. net.

This book is intended to provide a practical guide to the use of insulin in the treatment of diabetes in general practice. The author begins by devoting a chapter to the examination of the urine, followed by one on the clinical signs of diabetes. The examination of the blood and the principles of dietetics complete the first part of the book, which is concerned with diagnosis.

Treatment and complications form the other two broad divisions of the work. These are described in detail, in a lucid and readily understandable style, with new and original ideas embodied. The summing-up of the effect of insulin on the treatment of diabetes enables the reader to form a just appreciation of the advantages, together with the present limitations, of the new form of treatment; the author insists on the necessity of explaining to patients that insulin at present is not a cure for diabetes, but that the daily use of it, combined with dietary restrictions, will enable them to keep the disease in abeyance. Even so, he concludes with the following: "Much remains to be done, and many problems are still unsolved, but for what has already been accomplished, the discovery of insulin by Dr. Banting will go down in history as one of the epoch-making events in the treatment of human disease."

The book should be of value to practitioners and to students as it embodies the details of the treatment in a concise manner.

M. B. H. R.

Notices.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc. He will also be glad to receive items of news and information regarding matters of interest to the Corps from the various garrisons, districts, and commands at home and abroad.

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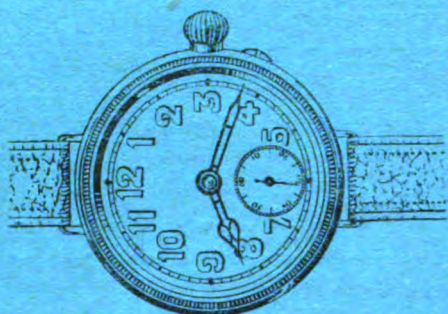
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Journal
of the
Royal Army Medical Corps.

Original Communications.

THE WADI HALFA QUARANTINE.

By MAJOR B. H. H. SPENCE.

Royal Army Medical Corps.

INTRODUCTORY.

FOR the past few years gigantic irrigation works have been under construction in the Anglo-Egyptian Sudan, the immediate object of which is to bring under cotton cultivation the great wedge of 300,000 acres of waterless but fertile land lying between the confluence of the Blue and White Niles, and known as the Gezira. The area under cultivation may eventually be extended to 600,000 acres.

Ankylostomiasis and schistosomiasis are already endemic in the Anglo-Egyptian Sudan wherever conditions are favourable for their propagation [1]; it is therefore reasonable to apprehend that unless special measures are taken to control their spread they will eventually convert the whole Gezira area into a hotbed for their dissemination, comparable to the valley and delta of the Nile in Egypt. No doubt by the strict application of the knowledge we possess the Gezira could be kept entirely free from these diseases. But economy is a vital factor in ambitious schemes of development, and absolute perfection in hygienic matters may easily be attained at too high a price. It would, in fact, be just as reprehensible to paralyse the scheme by taking too elaborate hygienic precautions as it would be to wreck it by taking none at all.

The Government of the Anglo-Egyptian Sudan therefore may as well reconcile itself to the fact that some degree of infestation of the Gezira with parasitic worm diseases is inevitable, and take steps accordingly to control the spread and combat the effects of these diseases in such a way as to

prevent the ultimate success of the scheme being imperilled through a general lowering of the economic efficiency of the labouring population.

This end it can achieve by ensuring that the education of the people shall include instruction in the nature, mode of spread, and effects of these diseases, by organizing village conservancy and water supply on lines which will reduce to a minimum pollution of the soil and canals by human excreta, by destroying periodically, by physical and chemical means, snails, especially in the tertiary canals, and by establishing one or more travelling anthelmintic hospitals for the purpose of examining all labourers and their families at stated intervals, and treating those found to be infested.

When construction work in the Gezira began on a large scale at Makwar and Gebel Aulia in 1920, the floating labour population of the Anglo-Egyptian Sudan numbered only some 5,000 men. It became necessary, therefore, to import the remaining 15,000 from Egypt, a country in which the majority of the labouring population are known to suffer from one form or another of parasitic worm disease, chiefly ankylostomiasis, schistosomiasis and ascariasis. Conditions in the Anglo-Egyptian Sudan made construction work possible only during a portion of the year. The term of engagement of these labourers was therefore for six months, an arrangement which suited them very well as it enabled them to return to work in the fields in Egypt at an important season. There thus arose the prospect of 15,000 Egyptian labourers, not necessarily the same ones, being imported into the Anglo-Egyptian Sudan every year until construction work in connexion with the Gezira Irrigation Scheme should be completed.

The Sudan Medical Department, recognizing that full economic value could not be obtained from a horde of diseased workmen, and fully alive at the same time to the danger that would be incurred by introducing them in their native state into the Gezira, decided to establish a quarantine at Wadi Halfa, the boundary town between Egypt and the Anglo-Egyptian Sudan, for the purpose of examining them all and treating those found to be infested before allowing them to enter the country.

This quarantine was also designed to act as a check against the introduction of cholera, which occasionally visits Egypt, plague, which has been endemic since the pandemic of 1899, and smallpox, typhus, and relapsing fever which are always present. An indication of the part played by these diseases is given in Table I, compiled from the report of the Public Health Department of Egypt for 1919.

TABLE I.

Disease	Cases	Deaths	Case mortality
Cholera	<i>Nil</i>	<i>Nil</i>	<i>Nil</i>
Plague	877	473	54 per cent
Smallpox	7,895	1,926	24 "
Typhus	16,970	5,569	33 "
Relapsing fever ..	3,276	598	18 "

The Anglo-Egyptian Sudan is normally protected against the introduction of cholera and plague from Egypt by the excellent arrangements of

the Public Health Department of the latter country for the rapid diagnosis and early notification of these diseases, and for the effective control of contacts. Further protection is also afforded by the medical inspection of immigrants on arrival at Wadi Halfa, after a journey by river steamer lasting two days.

THE BUILDINGS.

In the autumn of 1920 there was in existence at Wadi Halfa a small quarantine (fig. 1) designed to cope with any outbreaks of infectious disease which might occur on steamers entering the Sudan from Egypt. It consisted of a 20-bedded hospital, a high-pressure steam disinfecter, a store, a house for the Medical Officer, and eight wire-netting compounds containing a few palm mat shelters which had all been blown down during a violent gale in the spring of the year. Tentage sufficient for the accommodation of some 300 men was also available.

As it was anticipated that batches of 450 to 750 labourers would arrive twice a week, and would have to be dealt with at the rate of 150 to 250 a day, it was obvious that existing accommodation was inadequate. Extra tentage was therefore obtained. No. 1 compound was then set apart for the reception of the batch on arrival; No. 2 for the reception of the section of the batch undergoing purgation and starvation as a preliminary to anthelmintic treatment; No. 3 for the reception of the same men for the collection of all faeces passed by them after anthelmintic treatment; and No. 4 for the accumulation of men prior to the dispatch of the batch to Khartoum. The four small compounds were used for the reception, pending their return to Egypt, of men found unfit at the medical inspection.

The hospital building was converted into laboratory, storerooms, and quarters for the laboratory attendant. A large amount of storage was required because each man brought with him an enormous sack of dried bread for use during his six months' sojourn in the Sudan. These sacks had to be kept under lock and key during anthelmintic treatment. The disinfecter and medical officer's house continued to be used for the purpose for which they were designed. Extra bucket latrines and urine soak pits had to be constructed in all the compounds. Near the landing place a wooden fence was erected to form three sides of a square, numbers from 1 to 250 being painted on the rail at 80-centimetre intervals. This was to facilitate the checking and marking of the men and their examination by the Customs authorities on arrival.

Accommodation had still to be provided for the medical inspection, lousing and vaccinating of 250 men a day. For this purpose a group of palm mat buildings was constructed from the wreckage of the palm mat shelters already referred to. The lay-out of these buildings, which is shown in fig. 1, was designed to enable the various operations to be performed concurrently, to ensure that the men should progress steadily from dirtier to cleaner ground, to prevent substitution taking place during the medical

The Wadi Halfa Quarantine

HUMAN QUARANTINE, WADI HALFA, SUDAN. MARCH 22, 1921.

Scale 1: 500.

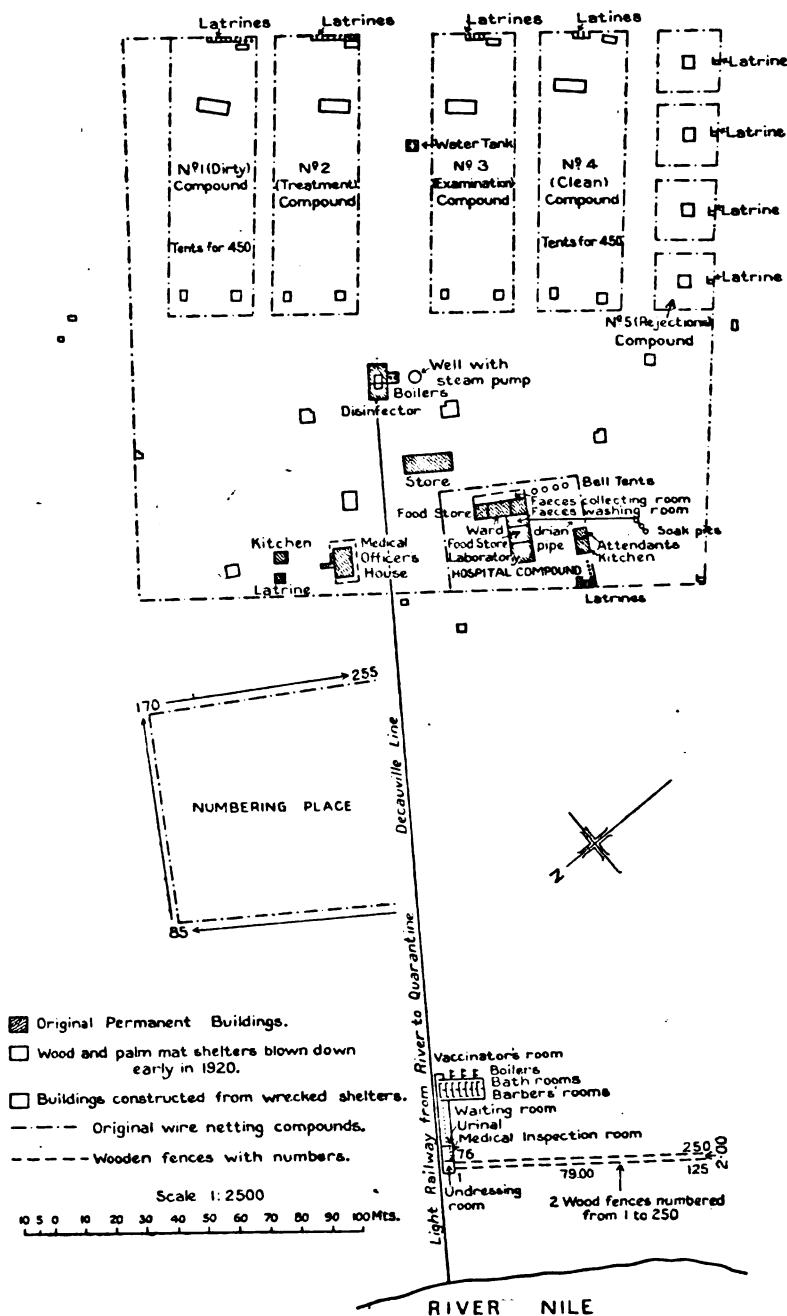


FIG. 1.—Plan of the Wadi Halfa Quarantine.

examination, and to enable the work to be supervised by the smallest number of employees possible. Outside this building a wooden fence was erected, numbers from 1 to 250 being painted on the rail at 80-centimetre intervals. Beneath each of these was suspended a net bag bearing the corresponding number.

THE DAILY ROUTINE.

Twice a week during the winter of 1920-21 some 450 to 750 labourers arrived at Wadi Halfa by steamer (fig. 2). Each batch was divided into three sections of 150 to 250 men, the latter number being the maximum that it was ever necessary to deal with in a day, as the Sudan Government railways and steamers were unable to carry more than 1,500 men a week. Each batch, less the men found unfit, was dispatched to Khartoum on the fourth



FIG. 2.—Labourers disembarking at Wadi Halfa.

day after its arrival at Wadi Halfa. It would have been very convenient if each section could have been dispatched when finished with, but this was impossible, owing to lack of trains. In any case the few extra days of detention provided an additional safeguard not altogether undesirable from the quarantine point of view.

On disembarkation the men were lined up in the numbering place where their names, after being checked with the nominal rolls in possession of the "mugaddimin," or foremen, were entered on the quarantine form. Each man usually had with him a small box or bundle of clothing, and one or sometimes two large sacks of coarse dried bread, which, mouldy and unpalatable as it appeared to be, though no doubt full of vitamins, formed his staple article of diet during his six months' sojourn in the Sudan.

The Customs police overhauled these bread sacks very thoroughly, probing them in all directions with a sharp steel rod. On one occasion at least, the presence of a tin containing about two pounds of raw opium was detected in this way.

In order to avoid substitution and to keep track of the men during the various processes they had to go through in the quarantine, it was found essential to number them serially, and to affix the numbers in such a way that they could not be removed. This end was attained by painting the



FIG. 3.—Administering the preliminary purge.



FIG. 4.—Awaiting medical inspection.

numbers in Arabic on the men's forearms, using a ten per cent solution of silver nitrate for the purpose; these numbers blackened rapidly on exposure to light, were indelible, and lasted for several days. The men of the first, second, and third sections were numbered on the right arm, left arm, and chest respectively.

As soon as the process of numbering was finished, usually towards the evening, the men of Section I were deprived of their bread sacks and locked up in No. 2 compound for starvation as a preliminary to anthelmintic treatment, whilst the men of Sections II and III were locked up with all their belongings in No. 1 compound.

At 6 p.m. the men of Section I received a preliminary purge (fig. 3), and next day between 6 a.m. and 8 a.m. they received anthelmintic treatment. At 8 a.m. their clothing was removed for disinfection, shirts being issued instead to keep them warm whilst awaiting their turn for medical



FIG. 5.—Berberine barber at work.

inspection (fig. 4). Between 8 a.m. and 11 a.m. they filed through the medical inspection room, where their percentages of hæmoglobin were estimated by means of the Tallquist hæmoglobinometer, and their urines were collected for subsequent microscopical examination. They next passed into the barbers' rooms where their heads were cropped and their bodies shaved (fig. 5). Thence they passed into the bathrooms, on emerging from which, louse free and clean from head to toes, they were vaccinated against small-pox (fig. 6) and given a second purge. They then claimed their disinfected clothing, exhibiting as receipts the corresponding indelible numbers on their forearms. Finally they were locked up in No. 3

compound where all fæces passed by them were collected till 6 p.m., at which hour they were released to enable work to begin on Section II.

The urines were examined by the laboratory assistant on the day of collection for the presence of the ova of *Schistosoma hæmatobium*.

Fæces were sifted and worms recovered by a locally trained laboratory attendant on the day following collection, for subsequent counting and classification.



FIG. 6.—Native vaccinator at work.

DISINFECTION AND LOUSING.

The disinfector available at Wadi Halfa was a small high-pressure Thresh holding between thirty and forty kits. The clothing was loosely rolled up and placed in the net-bags which were stowed in the disinfector without pressure. Extra apparatus was necessary to prevent delay and disorganization. An old derelict high-pressure steam disinfector was therefore pressed into service and converted into a current steam disinfector, the steam being led in at the top of the apparatus and allowed to escape at the bottom. If steam is admitted below and allowed to escape above it forms in the first instance whirling clouds of partially cooled steam

and partially heated air. Much of the steam seeking the shortest route to the exit above passes through the chamber without having done any work, and considerable delay occurs before all the air is expelled. There is thus waste of fuel and time and a liability to patchy disinfection.

On the other hand if steam at 100° C. is let into a chamber from above, it forms a column at the top of the chamber consisting of steam at 100° C. without any admixture of air. A continuous supply of steam causes this column to extend gradually downwards, its lower surface remaining horizontal all the time and driving all the air before it. It fights its way downwards in an even layer, saturating everything as it advances and driving every particle of air before it. No steam escapes till it has done its work. In the first instance only cold condensed water from the steam-air junction escapes at the waste pipe below. As the column of steam at 100° C. extends downwards the water of condensation becomes hotter and hotter till at last the whole chamber is filled with steam at 100° C. and steam alone escapes at the waste pipe. This is the moment from which to time disinfection. By this arrangement the services of an engineer are dispensed with, time and fuel are saved, an absolutely even temperature is maintained throughout the process (provided of course that enough steam is supplied to ensure the escape of steam at 100° C. below) and disinfection is perfect.

As regards the time required, exposure to steam at 100° C. for thirty minutes may be regarded as allowing a wide margin of safety. The improvised disinfector held fifty kits. Thirty minutes usually elapsed before pure steam issued from the escape below; from the moment when this occurred thirty minutes' exposure was allowed. The kits were so hot on removal that they became dry almost instantaneously. A kit from the bottom of the disinfector was always examined and in no case were viable lice or nits found.

Of the 14,077 men imported from Egypt 100 per cent. were found to be lousy. It was common to find men who harboured 1,000 lice. In rare cases the total by rough calculation approached 10,000. By holding the shirt of one of these men in the cold air for a few moments a steady stream of lice could be observed to drop from it to the ground.

The process of disinfecting a lousy man is not complete unless it embraces the removal of the body hair, on which nits can almost invariably be found. Failure to recognize this fact is the chief reason for the recurrence of lousiness in men who have been bathed and whose clothing has been disinfected. This was well brought out during the war in Palestine where the Egyptian Labour Corps, in spite of apparently excellent lousing arrangements, suffered severely from typhus and relapsing fever, simply because their body hair was not removed.

Weak antiseptic baths kill neither lice nor nits, and it is merely tinkering with the problem to apply greases either to the body or the clothing. The hair of the head must be cropped as close as possible, and the hair of the body must be shaved off.

Seven local barbers were enlisted for this service. At first the work was heavy, but in the course of time word got back to the villages in Egypt and many men used to arrive at Wadi Halfa with heads already cropped and pubes and axillæ shaved.

Cropping, shaving and bathing were on the whole popular features of the routine. The men welcomed the chance of a clean up, especially as it cost them nothing. From time to time, however, a long-haired citizen would lodge a protest. The objector was invariably told he would be exempted if no lice or nits were found on him. There were no exemptions.

In connexion with the removal of body hair undoubtedly a certain amount of bribery used to occur. It was an easy matter for a black-visaged Berberine barber with a menacing look in his eye, a large sharp razor in one hand, and a man's genitalia in the other, to ask his victim if he happened to have half a piastre about him! No doubt many were induced in this manner to compound for a comfortable shave, but it was not till one of the victims accidentally swallowed his half piastre, and the coin was recovered during the sifting of the fæces, that we discovered both the existence of the system and the method by which the money was conveyed to the barbers' rooms by a naked and empty-handed man!

As the result of this lousing routine not a single case of louse-borne disease occurred amongst the men during the working season of 1920-21. That the men owed their immunity from these diseases to efficient lousing and not to any climatic influence is clearly established by the fact that 2,000 labourers from Arabia, who were admitted to the Gezira at the same time as the Egyptians, but via Port Sudan, and without being subjected to a proper lousing routine, suffered so badly from an outbreak of relapsing fever that they had to be returned to their country.

ANÆMIA.

Every man was examined for anæmia by means of Tallquist's hæmoglobinometer. With this instrument, a drop of undiluted blood is soaked up by absorbent paper of standard quality and compared by reflected daylight with a paper colour scale of ten tints representing percentages of hæmoglobin ranging from 10 to 100. The reading is taken at the moment the stain loses its humid gloss.

Using a new scale which had been carefully protected from the light, and following Tallquist's original instructions to the letter, 2,837 consecutive specimens of blood were examined. Not only were the readings found to be consistently lower than control observations made with von Fleischl's hæmoglobinometer, but also the blood tint, whatever the percentage of hæmoglobin, appeared always to belong to an altogether lighter scale of colours. This led to great uncertainty in the readings, an uncertainty which did not in the least diminish with practice.

The defect appeared to me to be due to the fact that the observations were being made in the intensely brilliant light of the Northern Sudan.

A stain of normal blood on the type of absorbent paper supplied with the scale renders the paper slightly more transparent than it already is, in consequence of which, if Tallquist's instructions are followed and the sheet of absorbent paper folded down the middle so as to bring a clean white surface beneath the stain as a background, a certain amount of light must be reflected back through the stain. That this actually happens to a degree depending upon the nature of the background and the brilliance of the illumination everyone can satisfy himself by trying the effect of placing different backgrounds, say white, black and red, behind stains of normal and anæmic blood, and then comparing them with the scale, and also by varying the intensity of the illumination when using a white background.

Tallquist's instructions that a white background should be used and that the stain should be examined by light reflected off the surface and not by light reflected through it, are therefore somewhat contradictory.

It has frequently been observed that when the scale is used in a dull climate, such as that of Scotland, the tendency is for it to give readings which are too high, the reverse of what is found when the scale is used in a country where the light is dazzling.

One is therefore led to suppose that Tallquist constructed his scale for use in light less dazzling than that of the Northern Sudan but brighter than that of Scotland, and that he consciously or unconsciously allowed for a certain amount of light being reflected back through the stain.

In an endeavour at Wadi Halfa to get readings which accorded with observations made with other instruments various backgrounds were tried in place of a white one. A dark background was found to improve the accuracy of the higher readings very considerably, but to give the lower readings a greyish tint which interfered with comparisons. Eventually a duplicate scale was pasted on to the back board of the book behind the scale in use, in such a manner that each opening had behind it the corresponding tint, the idea being that any light which might be reflected back through the stain would approximate as closely as possible to the actual colour of the stain under examination. This appeared to answer the purpose admirably. The bloods of a series of sixty men with varying degrees of anæmia were examined by the modified Tallquist's and by von Fleischl's hæmoglobinometers, three observations being made in each case with each instrument. The average of all the readings by the modified Tallquist was seventy-five per cent, against seventy-three per cent by von Fleischl's instrument, a negligible difference.

With the Tallquist scale modified, as described above, the bloods of the remaining 10,869 men were examined. The results are shown in Table III.

TABLE III.

Number of Bloods examined, 10,869.

Percentage of hæmoglobin		Number of men		Percentage of men		Degree of anæmia
100 — 96	..	10,341	..	95.0	..	Nil
95 — 76	..	480	..	4.4	..	Mild anæmia
75 — 46	..	48	..	0.5	..	Moderately severe anæmia.

The men in the lowest category were returned to Egypt.

These observations accorded well with the healthy, sturdy, well-nourished appearance of the men as a whole. They do not, however, afford any indication of the prevalence or severity of anæmia amongst the labouring classes of Southern Egypt, because the men were really a selected body on account of the fact that only under very exceptional circumstances would a man be likely to volunteer for service in the Anglo-Egyptian Sudan unless feeling in perfect health.

It was noted in certain cases that the only obvious explanation of the presence of severe anæmia was heavy infestation with lice. This is not surprising when it is recollected that a man with 1,000 lice on him, no uncommon person in Egypt, has to suffer the injection of 5,000 doses of irritating salivary juice, and provide 5,000 meals of blood every twenty-four hours [2]. These bites result in irritation by day and sleeplessness by night; the sufferer's body becomes excoriated from head to foot, and the scratches very often become the seat of pyogenic infection. Small wonder that he becomes in time anæmic. The louse problem in Egypt is one which has not yet received the full attention it merits, doubtless owing to the overwhelming importance of parasitic worm infestation.

ANKYLOSTOMIASIS.

It was decided to regard all the labourers as ankylostome carriers, and to treat them accordingly. The two anthelmintics available at the time the quarantine was opened were thymol and chenopodium oil. Whichever was used the men were allowed no food after the evening meal, and at 6 p.m. were given a saline purge, consisting of 25 grammes of magnesium sulphate in 50 cubic centimetres of water. Next morning they were given either 4 grammes of thymol, divided into two doses, given at 6 a.m. and 8 a.m., or 3 cubic centimetres of chenopodium oil, divided into three doses, given at 6 a.m., 7 a.m. and 8 a.m. As they emerged from the lousing building, between 11.30 a.m. and 1 p.m., they received a second purge similar to the first, and were then shut up till 6 p.m. in a compound specially set aside for the collection and examination of fæces.

In a room in this compound shelves were put up for the accommodation of 250 enamelled iron basins, ten inches in diameter, with tin lids, and numbered from 1 to 250. The places for the basins were also numbered, and in each basin was placed a metal disc bearing the corresponding number. It will be recollected that the men themselves were marked with indelible numbers. When a man desired to defæcate he entered the room and exhibited the number on his forearm to the attendant who gave him the basin bearing his duplicate number. He defæcated into this, urinating into a separate receptacle, and then returned the basin to the attendant who replaced it on the shelf till it was required again. In this manner all fæces passed by the men were collected between 6 a.m. and 6 p.m. on the day of treatment.

Next morning two locally-trained laboratory attendants sifted each collection of fæces and recovered the worms for subsequent counting and classification. A basin containing fæces and identity disc was inverted over a fine wire sieve containing fifty meshes to the linear inch. A gentle stream from the tap was allowed to play on the sieve till all the soluble and finely divided material had been washed through. The sieve was then inverted over a black papier mâché tray into which the identity disc fell, followed by the worms, aided by a gentle stream from the tap. The worms, rendered visible by the black background, were easily picked

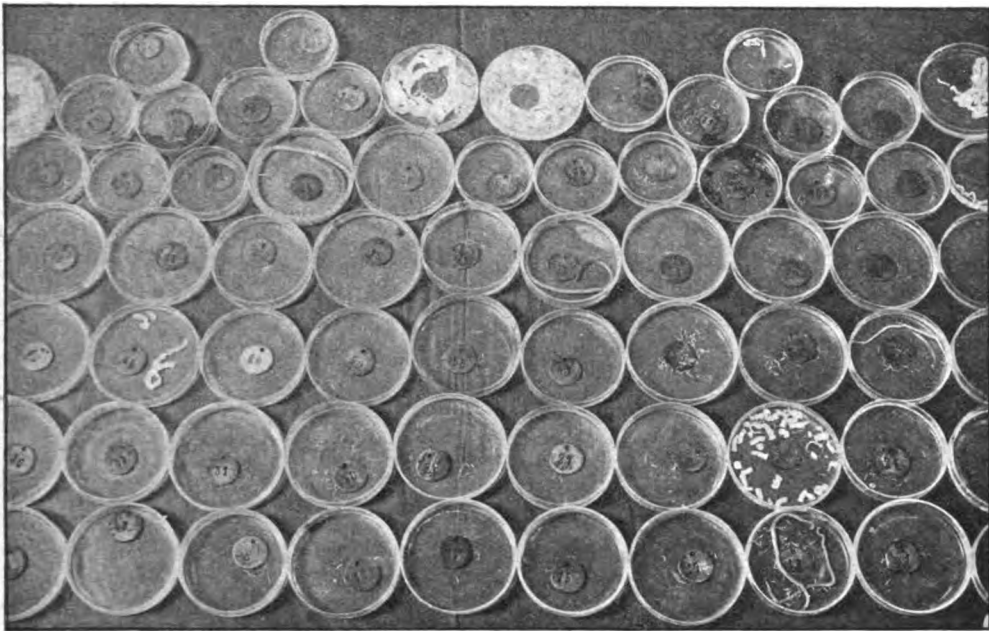


FIG. 7.—Collection of worms from 150 men.

up with a toothpick and placed in a Petri dish containing normal salt solution, to which the identity disc was also transferred (figs. 7, 8, 9 and 10).

Two hundred and fifty men generally yielded about 100 carriers of different kinds of helminths. The results were entered opposite the men's names on the quarantine forms which accompanied them to their destinations at Makwar or Gebel Aulia.

The results of treatment were observed in 8,088 of the 14,077 men who were treated. These are set out in Table IV.

From this it would appear that four grammes of thymol are more efficacious than three cubic centimetres of chenopodium oil in the treatment of all forms of parasitic worm infestation amongst Egyptians, an observation which receives further support from the fact that the propor-

tion of ankylostomes recovered from cases treated with thymol and chenopodium oil was as five to three respectively.

TABLE IV.

Anthelmintic	Number of men treated :	Thymol: 4 grm. in two doses		Chenopodium Oil, 3 c.c. in three doses	
		6,641		1,447	
Kind of worm recovered		Number of carriers	Percentage	Number of carriers	Percentage
<i>Oxyuris vermicularis</i>	1,847	27.7	320	22.1
<i>Ankylostoma duodenale</i>	..	1,280	19.3	203	14.0
<i>Tænia saginata</i>	151	2.3	24	1.7
<i>Ascaris lumbricoides</i>	132	2.0	27	1.9

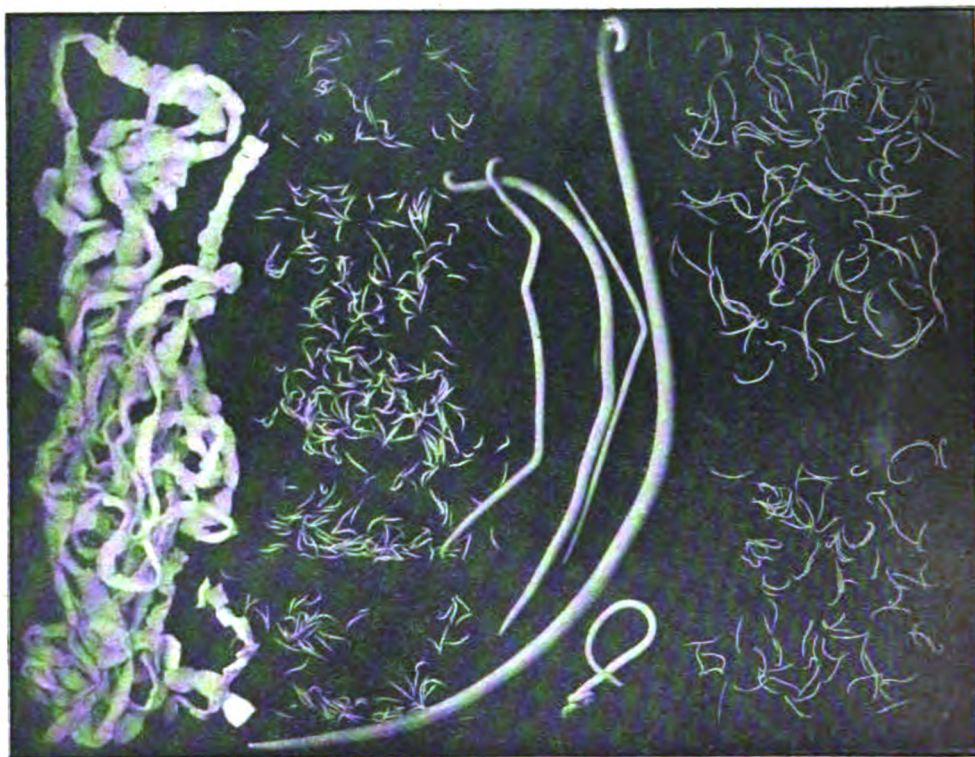


FIG. 8.—The day's haul sorted out.

The figures in Table IV do not of course indicate the real prevalence and degree of parasitic worm infestation either amongst the labourers examined, or amongst the labouring classes generally in Southern Egypt, firstly because no examination for ova was made and only twelve hours were available for the collection of fæces after treatment, and secondly because the men examined were a selected body who felt fit enough to volunteer for service in the Anglo-Egyptian Sudan and therefore presumably were not seriously infested with parasitic worms.

None of the cases of ankylostomiasis exhibited the purple streaked

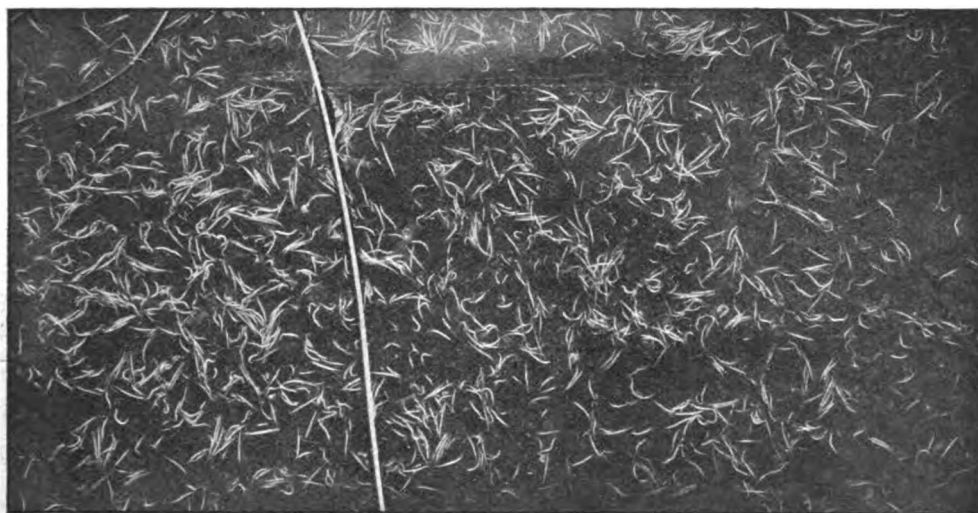
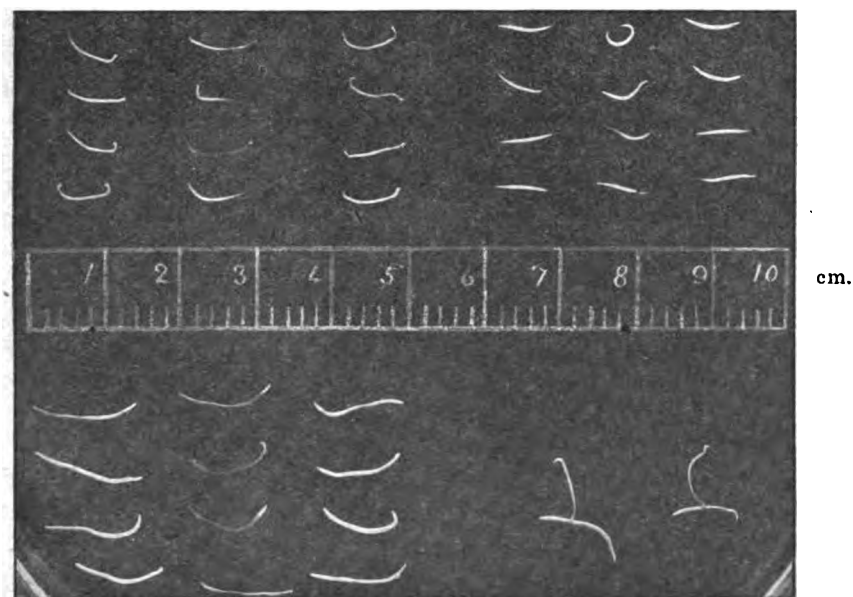


FIG. 9.—3,000 oxyuris recovered from one man.

Ankylostoma duodenale ♂.

Oxyuris vermicularis.



Ankylostoma duodenale ♀.

Copulating ankylostomes.

FIG. 10.—Comparative size of male and female ankylostomes and oxyuris.

The middle column of ankylostomes contains fresh blood.

pigmented tongue described by Delamare as pathognomonic of the disease, though the pale, flabby tongue of anæmia was not infrequently encountered.

The earliest and most valuable clinical indications of the presence of ankylostomes in the small intestine are discomfort and tenderness in the epigastrium. The presence of epigastric discomfort in an Egyptian is a clear indication for examining his fæces for ova.

In no case were more than 200 ankylostomes recovered, an observation in keeping with the general appearance of the men and the low percentage and comparatively mild degree of anæmia encountered.

Several thousand male and female worms were examined, but only *Ankylostoma duodenale* was met with.

Larvæ of sarcophagid flies were frequently recovered from fæces, and on one occasion a large bott, the larva of an œstrid fly, was secured.

URINARY SCHISTOSOMIASIS.

A portion of the urine of each labourer was collected in a test tube bearing his number and was subsequently centrifuged and examined microscopically for the presence of ova of *Schistosoma hæmatobium*. It was found that about twenty per cent of the men suffered from nervous retention of urine when called upon to micturate in the medical inspection room. As the granting of privacy would have resulted in substitution of urines, and as delay would have disorganized the whole routine, fifty No. 9 gum elastic catheters were sterilized and kept ready for use each morning; any man who was unable to micturate at the psychological moment found himself successively on a couch, catheterized, and bundled into the barbers' room before he quite realized what had happened to him. Only one stricture was encountered in 3,000 men who were catheterized. The results of the examination for urinary schistosomiasis are shown in Table V.

TABLE V.

Number of men examined	..	..	..	..	14,077
Number affected with urinary schistosomiasis	..	..	..	..	2,600
Percentage affected	..	..	..	..	18.5
Number rejected for urinary schistosomiasis	..	..	..	..	97
Percentage rejected	..	..	..	..	0.7

All men affected with urinary schistosomiasis who had poor physique, severe hæmaturia, marked anæmia, or pyuria were rejected, as they would most probably have broken down under the stress of hard work if allowed to proceed to the Anglo-Egyptian Sudan.

The remarks as to deductions to be drawn from the statistics collected in regard to anæmia and ankylostomiasis apply also in the case of urinary schistosomiasis.

I suggested that schistosomiasis carriers should either be treated before being allowed to enter the Anglo-Egyptian Sudan, or else be sent back to

Egypt. The Central Sanitary Board, however, decided to allow them in without treatment pending the opening of the canals.

NEW BUILDINGS.

Tents were found to deteriorate very rapidly under the action of wind and sun and moreover afforded very inadequate protection against the cold north wind which prevails at Wadi Halfa in winter. Wire netting compounds proved to be useless for confining the men. The palm mat buildings in which the men were inspected, cropped, shaved, bathed, and vaccinated, gave them little or no protection from the cold wind. The floors of these buildings, at first sand, and later mud brick, were difficult to free from lice at the end of the day's work. Finally all the bath water had to be carried.

Plans were therefore submitted for the erection of more adequate and permanent buildings at a cost of £7,000. This sum was granted the more readily perhaps because it was realized that the old quarantine would prove very inadequate should it be put to the test of dealing with an extensive outbreak of say, cholera, plague, or typhus.

The plans were duly approved, and the buildings were erected by September, 1921 (fig. 11), in time for the beginning of the recruiting season 1921-22. The buildings have been in full use ever since, and have proved satisfactory to a succession of medical officers.

For the accommodation of the men a parallel series of long mud brick buildings with vaulted corrugated iron roofs were erected, the roofs being covered with mud bricks to ward off the rays of the sun. The ends of these buildings were connected by high walls covered with broken glass, which solved the problem of the confinement of the men very satisfactorily.

For the inspection, cropping, shaving and vaccinating of the men a group of buildings was erected round the existing disinfector building. This building was designed so that the men should progress steadily on to cleaner ground during the various processes. The men enter at door E, undress in room F, put their clothing in net bags bearing their respective numbers, pass the net bags through the hatch G into the dirty end of the disinfector room H. They then pass through door I into the room J where they are medically inspected and have their urine collected. Through door K they enter room L, there to await their turn with the barbers. As vacancies occur they pass through door M into the passage N, and thence into one of the barbers' rooms O, there to be cropped and shaved. Emerging into the passage P they pass through the door Q into the bath-room R. After bathing they pass through door S into room T where they are vaccinated, and draw their clothing through the hatch U from the clean end of the disinfector. Emerging finally at door V they receive their second purge and proceed to the compound for the collection of fæces, there to meditate on the inscrutable ways of Providence personified in the *Inglizi*.

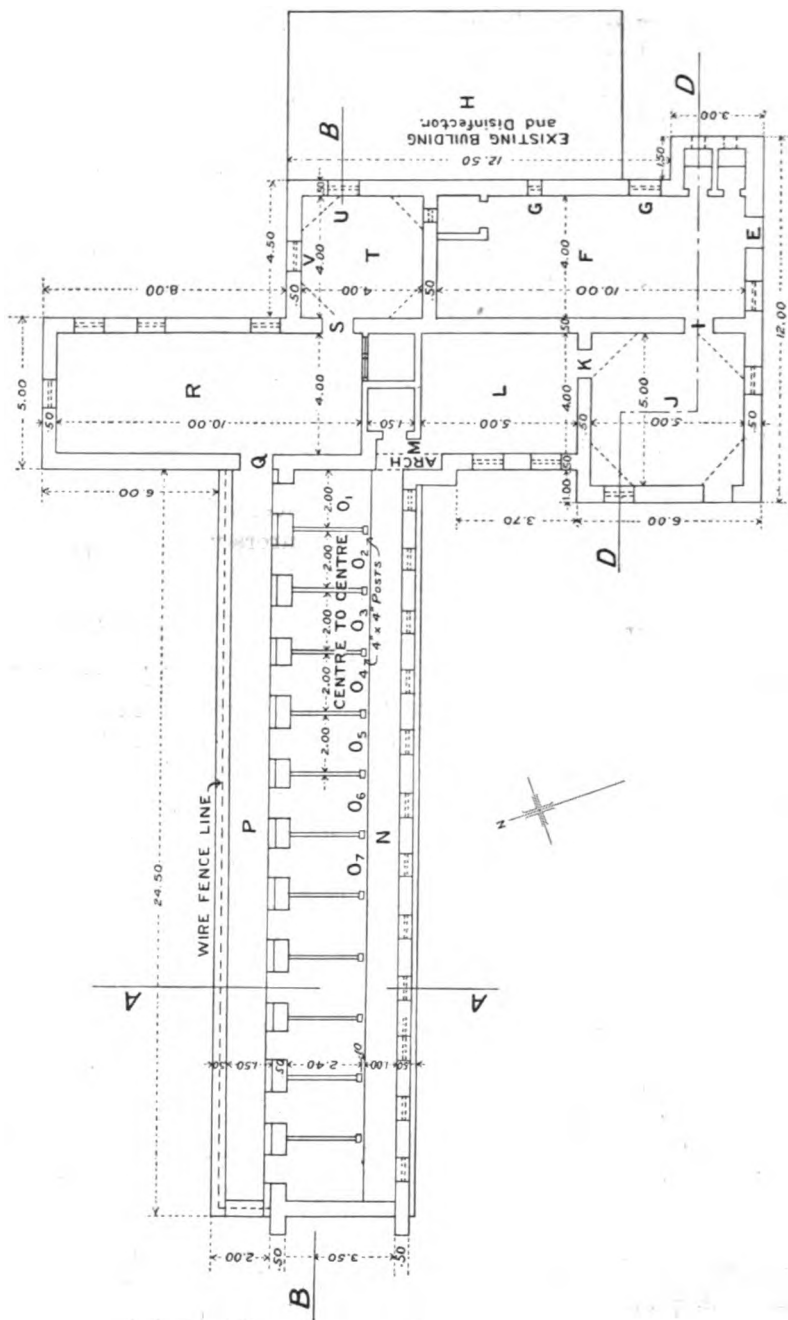


FIG. 11.—Plan of Lousing Building.

Did the fellah know anything of the mythology of his country he might be tempted to compare the horrors of his passage through the quarantine with those which the souls of his ancestors encountered on their journey through the portals of the underworld after they had "gone west," as they termed it. Probably, however, his thoughts centre mainly on the much more pressing problem of when he is going to get his next meal.

SUMMARY AND CONCLUSIONS.

(1) The Government of the Anglo-Egyptian Sudan, faced with the necessity of importing 15,000 labourers from Southern Egypt in the winter of 1920-21, decided to have them all inspected, loused, vaccinated and examined and treated for parasitic worm infestation with a view both to improving their value as labourers, and to protecting the country against the introduction of bacterial, protozoal, and metazoal diseases.

(2) The existing quarantine at Wadi Halfa was adapted for the ends in view.

(3) With a staff consisting of one medical officer, one laboratory assistant, and thirty locally enlisted Berberines, the labourers were inspected, loused, vaccinated, and examined and treated for parasitic worm infestation at the rate of 250 a day.

(4) 100 per cent of 14,077 labourers from Southern Egypt were found to be lousy. All men had their heads cropped and their bodies shaved. No cases of louse-borne disease occurred amongst these men throughout the season, whereas 2,000 Yemenis admitted at Port Sudan without proper precautions suffered severely from an outbreak of relapsing fever.

(5) Five per cent of 14,077 picked labourers from Southern Egypt were found to be anæmic. 0·5 per cent were so anæmic that it was considered advisable to send them back to Egypt. In the absence of parasitic worm infestation, heavy infestation with lice was the only obvious cause of anæmia in certain cases.

(6) Forty per cent of 14,077 picked labourers from Southern Egypt were found to harbour from one to four kinds of parasitic worms, twenty per cent having ankylostomiasis. Four grammes of thymol appeared to be more efficacious than three cubic centimetres of chenopodium oil in the treatment of parasitic worm infestations amongst Egyptians. In no case were more than 200 ankylostomes recovered from a man, a result in keeping with the general appearance of the infested men. Many thousands of male and female ankylostomes were examined. All proved to be *Ankylostoma duodenale*.

(7) 18·5 per cent of 14,077 picked labourers from Southern Egypt were found to be suffering from urinary schistosomiasis. 0·7 per cent had to be sent back to Egypt on account of the severity of their disease. Twenty per cent of these labourers suffered from nervous retention of urine when called upon to micturate during medical inspection. These men were catheterized, and in 3,000 so dealt with only one stricture was encountered.

(8) The Government of the Anglo-Egyptian Sudan, convinced of the value of the results achieved in the first year, spent £7,000 on the erection of permanent buildings which were completed in 1921 and have proved extremely useful ever since.

I have to record my appreciation of the excellent work done by Messrs. A. Marshall, A. Macdonald and R. A. Bertram, Assistants at the Wellcome Tropical Research Laboratories, Khartoum, who acted successively as my assistants at Wadi Halfa. I have also to thank Mr. E. S. Crispin, C.M.G., late Director of the Medical Department, Sudan Government, for the unfailing support he accorded me at all times, and also for permission to publish this paper.

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HÆMATOPHAGY AND HÆMETABOLY AS A NORMAL FUNCTION OF VARIOUS TYPES OF TISSUE-CELL.—II.

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THE GROWTH OF THE MAMMARY GLAND DURING THE LATER STAGES OF PREGNANCY, AND THE FORMATION OF COLOSTRUM, WITH INDICATIONS AS TO THE FORMATION OF MILK FAT.

THE idea of this work was conceived as a result of my study on the colloid of the thyroid gland [8]. The descriptions and figures of the colostrum in the acini of the mammary gland, together with the examination of a few ordinary preparations, in use for class work, which I was courteously permitted to see in the Histological Department of my old college, at once irresistibly suggested to my mind that the colostrum was a substance entirely comparable, as regards its mode of origin, with colloid; namely, that it was formed by direct metabolization of the red blood-corpuscles by the glandular epithelial cells, and thus furnished another example of normal hæmetaboly. My own research has fully borne out this view. And, in addition, I have been led to consider that the growth of the epithelium itself, prior to the commencement of its functional activity, is also directly associated with the metabolization of the blood elements; in other words, as a response to some special stimulus, the cells are enabled, for a limited period, to digest this solid, organized material for their own use, with marked increase of chromatin, active nuclear multiplication and cell proliferation as the result. I had hoped to study also in detail the actual formation of the milk in the lactating gland. But, unfortunately, I have found the work, as it is, has taken me much longer than I had expected it would do when I began, and I am obliged to bring it to a close now, with only a few indications bearing on this latter point.

My expenses in connexion with the work, including the cost of the photomicrographs and of their reproduction, etc., have been defrayed by means of grants which have been most kindly awarded me by the University of London, from the Thomas Smythe Hughes Medical Research Fund. All the photomicrographs have been kindly taken for me by Mr. A. Dennis; they are at a uniform magnification of either 600 or 450 diameters, to aid in comparison. It may be thought that I have an unnecessarily large number of illustrations, but I have felt that there was no better way of indicating my particular points than by reference to as complete a series as possible of actual photographs of the appearances to be seen.

I ought, perhaps, to add that the work does not profess to deal with the minute anatomy of the gland as a whole; my observations have had

reference almost entirely to this question of the relation between the epithelium and the blood. Hence I do not think a general review of the literature on the histology is at all requisite, but references in regard to special points coming under consideration and the interpretation of them given by earlier authors will be made in due course.

Material and Technique.

Material.—The animal used has been almost exclusively the guinea-pig, which is generally recognized to be very suitable for this study. I had greatly hoped to compare also the condition as seen in the cat, which was strongly recommended to me by Dr. Creighton, but in the circumstances am obliged, unfortunately, to leave that comparison for the present. One guinea-pig has been used for a special purpose. This animal was inoculated subcutaneously, on three successive days, with a solution of Indian ink, in order to differentiate between the epithelial cells and cells of reticulo-endothelial character, only the latter type of cell ingesting the particles of ink. I am very much indebted to Dr. S. P. Bedson for suggesting this experimental method and for most kindly performing the inoculations for me. The guinea-pigs were mostly killed from a week to ten days before the expected time of delivery, as nearly as could be judged; but one or two were killed immediately after the births had taken place, and another a few days after, with a view to comparing the condition found during lactation.

Technique.—The same procedure has been followed as was adopted in the case of my study of the colloid of the thyroid. As fixatives, I have used my own mixture of sublimate-alcohol-acetic; also Flemming; and, on the recommendation of Dr. Bedson, Dominici's fluid (sat. aq. sublimate ten parts, formalin $1\frac{1}{2}$ parts, and a few drops of tincture of iodine). This last is also a very good fixative, but I have not found that the hæmatoxylin-eosin method of staining succeeds so well after it—at any rate, in the case of this particular gland; the staining is more diffuse and the nuclei do not stand out so sharply and precisely from the cytoplasm as after the other methods of fixation. It has proved very suitable, however, for showing up the hæmoglobin "vacuoles." As stains, I have relied chiefly upon iron-hæmatoxylin, followed by eosin or van Gieson's mixture. As I have pointed out previously, there are no stains superior to this combination; indeed, from the point of view of my work, essentially a blood study, I do not think there is another to equal it. But for comparison I have also used the Ehrlich-Biondi-Heidenhain triple stain. Further, the micro-chemical reaction for iron—a control which I regard as of very great importance in connexion with this subject—has been carried out, as previously indicated, namely, preliminary treatment for one, or two, days, with Merck's "perhydrol," diluted with an equal volume of distilled water, and subsequently the pot.-ferrocyanide + dil. HCl mixture in the usual manner.

(1) THE GROWTH AND INCREASE OF THE EPITHELIUM.

In an actively developing gland seven to ten days before expected delivery, the most characteristic feature is the general looseness and indefiniteness of aspect, if I may so put it, of the glandular epithelium, especially as regards its relations with the neighbouring tissues. This appearance is the more striking, of course, in the younger zones, where the newly formed epithelial cells are encroaching on and obliterating the connective tissue. We have here, it seems to me, a most important indication against the view of an invariably fixed position and sharp delimitation of the epithelium *vis-a-vis* other tissues; I have, indeed, already emphasized the significance of this point, in my paper on the essential nature of malignancy [9]. The explanation lies in the fact that the epithelial cells are capable of *wandering*; they can become detached from their fellows and migrate or spread, if only for a limited distance, into the surrounding zone. The increase of the gland, therefore, results by no means *only* from the more or less mechanical extension of finger-like processes, whether hollow alveoli or solid cores; to a considerable extent it is due to the *migration of cell-individuals to the blood-capillaries and channels*, and their multiplication in this situation. And I think it is highly probable that, at this stage, the cells are chemotactically attracted to the blood.

The two series of figures, one to four and five to nine, show this process. Each series is of corresponding fields, as seen in consecutive sections. In the case of the first series,¹ the epithelial cells are seen passing both from the wall of a ductule, glimpses of which are shown on the right-hand side, and also from the wall of the alveolus near the middle (between the osmic-blackened masses of fat), to surround the capillary (*cap.*) containing red corpuscles (*r.c.*). In fig. 3, the portion of the capillary which is here cut quite transversely is surrounded by three epithelial nuclei (*ep. N.*). It will be noted how, in this same figure, epithelial nuclei are also spreading northwards, from the wall of the same alveolus. I may say here that, as I pointed out in my cancer paper, I have regard chiefly to the nuclei, because in this migratory and extending phase the cells appear to have extremely little cytoplasm, which, indeed, I am often unable to distinguish with any certainty from the surrounding matrix. The second series (figs. 5 to 9) shows a more advanced stage in this investing of a vascular channel with what is destined to become, by multiplication, a wall of epithelium. In this case, the newly developing acinus has the form of a roughly V-shaped loop, the epithelial nuclei being connected up with those of the wall of the ductule on the left side (figs. 5 and 6) at one end, and with those forming the wall of a little bay or invagination (seen at the top of fig. 9) at the other end. (Fig. 9 is at a slightly higher level than fig. 8, as will be seen by comparing the

¹ It so happens that figs. 2 and 3 are magnified 600 diameters, while figs. 1 and 2 are at a magnification of 450.

position of the inpushing core of cells, x). The upper arrow in fig. 6 points to epithelial nuclei, offshoots from those of the main loop, coming into relation with another small channel containing blood-corpuscles. *Wherever there is blood the in-wandering epithelial elements seek it out.*

Fig. 10, at a higher magnification, is of another large blood-containing capillary or channel,¹ becoming enclosed by epithelium. The arrow points to a large nucleus undergoing constriction, prior to simple, amitotic division (cf. below). In this manner, numerous smaller nuclei are formed, as for instance those seen above, on the same side of the blood.

Now, it may be asked, why am I sure that all these nuclei *are* epithelial? Might they not be nuclei of connective-tissue cells, or of endothelial cells? I am practically certain of their epithelial nature and origin for the following reasons: (1) Because of their agreement in character with indubitable epithelial nuclei, e.g., of an acinus or of a ductule; and (2) because of their dissimilarity, in general, from those of the other types of cell mentioned. As a matter of fact I shall be indeed very disappointed if careful scrutiny of my figures does not also satisfy my readers as to this fundamental point. Taking the first reason, while there is considerable diversity as regards size and form among the undoubted epithelial nuclei, owing to their rapid growth and multiplication at this period, nevertheless in the "resting" condition they all show the same general type of structure. Round, oval or elongated, they are relatively loose and open; the membrane is well-marked and usually distinctly chromatinic; and the network contains a varying number (usually three or four) of fair-sized chromatin-grains. On the other hand, there is no danger of confusion with nuclei of connective-tissue elements. As regards the clasmatoocytes (cf. cf. fig. 1, and again fig. 20, where these cells are clearly shown), the nucleus is often very dense and compact; where the nucleus happens to be of looser character, there are always three or four relatively large chromatinic blocks, occupying much more of the nuclear area than do the chromatin-grains of epithelial nuclei. Moreover, the cytoplasm of these clasmatoocytes is very distinct and stains much more strongly with the eosin than does the cytoplasm of the epithelial cells (of the alveoli, for example). Again, as regards the nuclei of fibroblasts, etc., these are irregular and angular in appearance and nearly always very dense (cf. *conn. tiss. N.*, figs. 7 and 4); they are, moreover, sparse and scattered.

The one instance where, possibly, a mistake might now and again be made is with regard to the endothelial nuclei lining the blood-capillaries. And I am not going to say that, in every case, where there has been nothing else to guide me, I have always been able to decide correctly whether an *isolated* epithelial nucleus or an endothelial one was in question. But my point is this: an odd occasion such as I have alluded to *is of no*

¹ Sometimes these blood-containing spaces appear to be of the nature of sinuses rather than capillaries, lacking any definite endothelial wall.

consequence as compared with the great weight of positive evidence furnished unmistakably by my figures in favour of my general interpretation! And, as a rule, an endothelial nucleus *can* be readily distinguished. It is narrower and more compressed, and often, though by no means always, dense (cf. *endo. N.*, figs, 5, 11, 14); and where more open in character it is smaller than these large epithelial nuclei which come into relation with the blood, and usually lacks conspicuous chromatin grains. Fig. 21 shows this difference between endothelial and epithelial nuclei quite clearly. Now, fig. 12 clinches the matter, I think. Epithelial nuclei are seen applied to three vascular capillaries. In the case of that labelled (i), there is one nucleus; around the upper channel (ii) containing a corpuscle, there are three crescentic nuclei, one of which is slightly out of focus. Lastly, and most important, the largest capillary (iii) shows several small, dense endothelial nuclei, cut more or less transversely, in its wall, and applied to the outside and proceeding to enclose the whole capillary are the quite different epithelial nuclei.

The two series of figures which have been discussed were from sections of material fixed with Flemming. But in regard to one important point material fixed with the sublimate mixture has an advantage; namely, that in the latter case the iron-hæmatoxylin brings out more distinctly than it usually does by the other method of fixation the marked increase in the chromaticity of these larger migratory nuclei. Figs. 15 and 16 are of the corresponding field in consecutive sections. In the former, the lower arrow points to an intensely chromatinic epithelial nucleus which has become applied to the small capillary containing red corpuscles. The upper arrow-heads also point to nuclei with increased chromaticity, manifestly derived from the epithelium of the elongated acinus. In fig. 16 the lower arrow points to a large, elongated, very chromatinic nucleus, forming one of the outer layer of the wall of this acinus; and this nucleus, it will be observed, is manifestly of the same character as that applied to the capillary in the preceding figure. This section also shows a small, narrow endothelial nucleus of this capillary (*endo.N.*), and here again the great difference between the two will be apparent.

Figs. 17 to 19 give a good idea of the intense chromaticity of these large nuclei, in zones where the epithelium is rapidly extending. It may be noted that it is only in such areas that the nuclei are so intensely stained; that is to say, it is not a question of under-differentiation as a whole. In other parts of the same section the nuclei of constituted alveoli are much less deeply stained. In fig. 17 three or four such nuclei are developing outwards from the wall of a small alveolus. Figs. 18 and 19 show how huge, often irregular, these active nuclei may become. The general reticulum is thickened and more granular in character, and hence definite and discrete chromatin-grains are at this stage less conspicuous. At first sight, indeed, they might be taken to have no connexion with the "resting" nuclei of formed alveoli; but all transitions can be found,

as will be apparent from a scrutiny of my figs. 15 to 19. To anyone who realizes that all this enhanced chromaticity means a marked increase in the amount of iron present, these appearances must provide matter for thought. The arrow in fig. 18 points to a great crescentic nucleus nearly encircling a small capillary, containing a single red corpuscle. By comparison, the reference *r.c.*, in fig. 19, indicates a red corpuscle in such a capillary, which is now completely invested, seen in cross-section with a wall of epithelium. To put the matter concisely, the lumen of a newly-formed acinus or alveolus represents a blood-containing channel, which is (or has been) in direct communication with the vascular system.

The Significance of the so-called "Basket-cell" Nuclei.—In young alveoli, whose wall is often two cells, or even in places three, in thickness, the outer cell-nuclei tend to become markedly elongated in form, as distinct from the round or oval shape of those of the inner cell-layer (cf. figs. 1 to 3, 20). And it is instructive to note that the direction of elongation tends to be at right angles (tangential) to the diameter of the alveolus, as seen in cross-section. Such a condition leads on, I think, to the so-called "basket-cell" nuclei of fully-developed acini, concerning the origin and nature of which various views have been held. Typical basket-cell nuclei are seen in figs. 14, 22. As regards these basket-cells, Ebner, in Kölliker's "Handb. d. Gewebelehre" says (vol. iii, p. 47) that in opposition to the general view that the basket-cells belong to the connective tissue, he has expressed the opinion that they are epithelial elements, basing this view on their situation between the basement membrane and the glandular cells. From what I have shown, it will be agreed, I think, that Ebner is undoubtedly correct, and that the basket-cells are of epithelial nature and origin. But I must confess I have found nothing to indicate the existence of a definite, unbroken basement membrane. I can only say that the whole trend of this work of mine—evidencing the occurrence of hæmetaboly on the part of normal epithelial cells of different kinds—goes to show that these "basement membranes" have no real existence in the living condition, as impenetrable barriers; it would seem that they are more or less artificial appearances, a result, probably, of coagulation on fixation. I consider that the function of the "basket-cells" is to act as a reserve—able to inaugurate again, as may be required, this migratory process and the establishment of relations with fresh blood-channels, thus giving rise eventually to new alveoli. Their transverse position is of significance in this connexion, since the smaller blood-capillaries tend to run tangentially to the cross diameter of the alveoli, often partly surrounding these.

Note on the Mode of Nuclear Division.—While cytology, in its generally understood sense, namely, the study of nuclear division, and division mechanisms, does not come within the scope of this work of mine—that being a field to itself—nevertheless, I may point out that all my indications

so far as regards the stages I have studied, up to the commencement of lactation, are that nuclear division is direct. I have not seen a single instance of mitosis in all my material. And, indeed, on *a priori* grounds, the sight of all these huge, actively growing and multiplying nuclei itself strongly suggests amitotic division. Moreover, most of the older authors particularly refer to the occurrence of direct division of the nuclei, e.g., Sticker [6], Michaelis [3]; while Ottolenghi [4], dealing with the condition of the gland in the stage of lactation, recognizes the occurrence both of direct and indirect division. And it is, of course, quite probable that, in the *later* stages, for instance during periods of regeneration of the epithelium, mitosis does occur.

This direct division of the nucleus probably takes place quickly, and appears to be little more than a simple process of constriction and separation into two. It is indeed surprisingly difficult to catch, considering the great increase of the epithelium at this period. Two early stages in the constriction, giving the nucleus a bifid appearance, are seen in fig. 23 (*n.d.*); and in fig. 24 the arrow points to a later stage, where the dividing nucleus has more of a dumbbell form. And frequently two very similar nuclei are seen lying close together, almost in contact, which are probably the result of recent amitotic division. In fig. 2, for instance, where *N* indicates an elongated nucleus about to divide tangentially, immediately to its left are two nuclei, still slightly pear-shaped, which are, doubtless, the daughter nuclei resulting from such a division. I do not think that the division of big, elongated nuclei is always equal, or at least only binary (cf. the constricted nucleus to which the arrow in fig. 10 points); and in fig. 22 the arrow labelled (ii) points to three separate nuclei still in contact, which have almost certainly resulted from the tripartite division of a nucleus such as is indicated by the arrow (i).

The Significance of the Intimate Association of the Epithelium with the Blood-channels.—The epithelial cells metabolize (digest) the blood elements, and especially the hæmoglobin of the red corpuscles. Normal red corpuscles (*r.c.*) are seen in figs. 1 to 4, 13, 15 and 16; in these cases the epithelial cells have not yet begun hæmetaboly. But in figs. 6 to 10 the developing wall of epithelium has already altered the blood to a considerable extent. The process, as manifest microscopically, follows the characteristic lines which I have now on several occasions described (cf., for instance, my paper on the colloid of the thyroid). Corpuscles showing different degrees in the transition to pale hæmoglobin "vacuoles" are indicated by the arrow in fig. 8. Several of the figures, especially 7 and 10, show larger "vacuoles" resulting from the running together of three or four or more corpuscles into a single mass of hæmoglobin, such as is seen in the lower part of the blood channel in fig. 10. In fig. 13 the lowest arrow points to the lumen of an alveolus which is almost filled with such a large hæmoglobin-"vacuole," which still has the faintest pink tint. Ultimately the lumen appears empty, except for a delicate network, representing the persistent

envelope or stroma of corpuscles or corpuscular masses (cf. the areas indicated by the lower arrows in figs. 6 and 7). Thus a condition like that shown by the two larger alveoli in fig. 13 is reached.

If cells, e.g. leucocytes, happen to be present, these take apparently much longer to digest; thus in the upper alveolus of fig. 13 there is still left a recognizable polymorph (*P. M.*). Further, at times small areas as a whole, which are really extra-alveolar, may break down as a result of the digestive action of epithelium in course of active ferment-secretion. Such an area is seen in the middle of fig. 13 and includes still normal corpuscles (*r. c.*), pallid corpuscles in a channel (*p. c.*), lymphocytes, connective-tissue cells and even odd migratory epithelial cells. In such a case, the end-result is an alveolus containing cells of various kinds, more or less disintegrated (fig. 14, right, etc., fig. 12, shown in part, at the top). I think that such a result is also brought about by the breaking down of the dividing walls between two smaller alveoli, and the formation of one larger one, the lumen of which then includes, of course, all the obliterated cell-elements. Now, is not this mode of behaviour remarkable? Have we not here, unmistakably, a characteristic feature of a malignant condition? *Controlled and regulated malignancy*: paradoxical as this may appear, it is how the whole process can best be regarded!

The next question is, Why do the epithelial cells exercise this function of hæmetaboly? During the period of active growth I think there can be no doubt that the cells themselves assimilate the digested hæmoglobin, using the iron in the formation of the additional chromatin. And I think that the hæmoglobin is absorbed by the cells when in the condition manifest as the pale hæmoglobin-"vacuoles," at which stage it is probably in a more fluid condition. I have dealt above with alteration of the blood *en masse*, in order to demonstrate clearly this origin of the pale vacuolar areas. Now, in the next stage, we find these pale hæmoglobin-"vacuoles" inside the cells, where active nuclear increase is taking place. The following figures show this condition: fig. 15 (arrow labelled *vac.*), fig. 19 (the three arrows on the right), fig. 23 (the arrows labelled *p. Hg. vac.*), and fig. 26 (the arrow on the right). Frequently, moreover, as would be expected, such intracellular "vacuoles" occur where blood-channels containing pallid corpuscles, or faintly tinted hæmoglobin, are also in the immediate neighbourhood, as shown in fig. 19 (the two lower arrows on the right) and fig. 23 (the two arrows pointing upwards from below). In these cases, the intracellular hæmoglobin has undoubtedly been absorbed from the channels containing pallid, altered blood. Fig. 26 gives an instructive picture. On the left is a capillary with blood-corpuscles in different stages, some staining the normal colour, others being almost pale. Above, epithelial cells are seen beginning to surround this capillary and causing its breakdown; and the zone marked (*i*) shows well a group of nuclei in intimate relation with pallid corpuscles and "vacuoles." As they assimilate this nutriment, the nuclei increase in chromaticity and size (cf. the zone marked (*ii*) in the

same figure); in this manner are developed the huge, intensely staining nuclei such as are seen in figs. 17-19.

The actual ingestion of discrete, normal corpuscles (in contradistinction to the absorption of already altered and more liquid hæmoglobin) does not appear to be of common occurrence in the case of this epithelium. It does occur, however, on a small scale; the arrow in fig. 25 points to a normal corpuscle ingested by an epithelial cell, whose nucleus is partly wrapped round it.

Intranuclear Occurrence and Digestion of the Hæmoglobin.—On occasion a most interesting feature can be observed, namely, the actual absorption of the hæmoglobin by the nucleus itself¹; the assimilation and transformation into chromatin can thus take place in an intranuclear situation. Fig. 27 shows in the middle of the field a number of epithelial cells, forming the wall of an extending alveolus, several of whose nuclei have a very different appearance from that found generally (indicated by the arrows). The membrane is sharp and definite and of regular contour but lacks the customary chromaticity. The nuclear material is more or less retracted into a solid mass, and the space between this and the membrane is filled with a hæmoglobin-"vacuole"; sometimes this is still quite manifestly pink in tint (arrow *i*) and in other cases has only a trace of pink colour left. The same condition is seen in the loose, migratory epithelial cells of the growing margin in fig. 28, and again in a few cells in the walls of the alveoli in fig. 29. I should like to emphasize that there is no doubt about the intranuclear position of these hæmoglobin-"vacuoles." If the above figures are compared with figs. 23, 25 and 26 again, the difference between cytoplasmic (extranuclear) and intranuclear vacuoles will be, I think, clearly apparent.

A further interesting point is that, whereas the nuclei in general always stain black, or greyish black (according to the degree of chromaticity, or of differentiation as the case may be) and show no red or pink tint of eosin (the counterstain), the compact nuclear material in these particular nuclei has as well a strong red-pink tint. Again, where van Gieson has been used as the counterstain and the corpuscles are a strong yellowish colour, this nuclear material also has a marked yellowish tint, in addition to the black (the section from which fig. 28 was taken shows this; all the condensed nuclei in the figure have yellow in the black). I interpret this appearance as signifying that here, in this nuclear mass, is altered hæmoglobin undergoing transformation into chromatin. As the metabolism proceeds, the nuclear material becomes looser again and gradually spreads out to the nuclear membrane (cf. arrows labelled *iii*, figs. 29 and 30), and at the same time the red-pink tint is gradually lost. The nuclear membrane becomes more chromatinic, and the nucleus takes on again a

¹ Cf. also the intranuclear occurrence of hæmoglobin in the nuclei of the hepatic cells, described by Herring and Sutherland-Simpson (*vide* Adami, "The Principles of Pathology," vol. i, p. 45).

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loosely reticular and granular character (as seen in the right-hand alveolus in fig. 30). Lastly, it is important to note that the elongated nuclei lying just outside and tangential to the wall of the alveoli, which represent the basket-cell type of nucleus, also show these intranuclear hæmoglobin vacuoles in areas where this mode of behaviour is occurring (cf. *b.n.*, figs. 28 and 29). This is strong confirmation of their epithelial origin and nature.

EXPLANATION OF FIGURES.

(All are reproductions of photomicrographs, which were kindly taken for me by Mr. A. Dennis.)

The following abbreviations are used throughout for reference :—

<i>b. n.</i> = basket-cell nucleus.	<i>hgb.</i> = hæmoglobin-mass.
<i>cap.</i> = capillary.	<i>N.</i> = nucleus.
<i>cl.</i> = clasmatocyte (or plasma cell).	<i>n. d.</i> = early stage in direct nuclear division.
<i>col.</i> = colostrum.	<i>p. p. c.</i> (or <i>p. c.</i>) = pink or pale pink corpuscle (early colostrum)
<i>conn. tiss. N.</i> = connective - tissue - cell nucleus.	<i>r. c.</i> = red corpuscle.
<i>endo. N.</i> = endothelial nucleus.	<i>vac.</i> (or <i>hgb. vac.</i>) = pale hæmoglobin-“vacuole.”
<i>Ep.</i> = epithelial cell.	
<i>ep. N.</i> = epithelial cell nucleus.	

(For description see text.)

FIGS. 1 to 4.—Series to show migratory epithelial cells from a small alveolus and from the wall of a ductule coming into relation with and surrounding a blood-capillary. (Flem., iron-hæmatox. + eosin; figs. 1 and 4, $\times 450$, figs. 2 and 3 $\times 600$.)

FIGS. 5 to 9.—Another series to show the epithelium spreading inwards from a ductule and forming a wall to a more or less V-shaped (regarded spatially) blood-channel. (Flem., iron-hæmatox. + eosin; $\times 450$.)

FIG. 10.—Large epithelial nuclei spreading round a vascular channel, containing altered blood, and giving rise to smaller ones, which will constitute the wall of a new alveolus. (The arrow indicates a nucleus undergoing constriction, prior to direct division.) (As last; $\times 600$.)

FIGS. 11 and 12.—Epithelial nuclei coming into relation with blood-channels; in both cases endothelial nuclei are also seen. (As last; $\times 600$.)

FIG. 13.—Formed alveoli, the lumen of which represents a blood-channel. Also, a breaking-down area in the centre, with pallid corpuscles, altered cells, &c., which will ultimately become enclosed by epithelium. (As last; $\times 450$.)

FIG. 14.—To show the lumen of an alveolus containing two included epithelial cells. (As last; $\times 450$.)

FIGS. 15 and 16.—To show increased chromaticity of large nuclei, in wall of long alveolus; also a large epithelial nucleus which has come into relation with a blood-capillary. (S.A.A., iron-hæmatox. + eosin; $\times 600$.)

FIGS. 17 to 19.—Intense chromaticity of actively growing nuclei, during extension of epithelium. (As last; $\times 600$.)

FIGS. 20 to 22.—To show origin and behaviour of so-called “basket-cell” nuclei. (Fig. 20, Flem. figs. 21 and 22, S.A.A.; all iron-hæm. + eosin; $\times 600$.)

FIG. 24.—Direct (amitotic) nuclear division; stage showing elongation and constriction. (S.A.A., iron-hæm. + eosin; $\times 600$.)

FIGS. 23, 25 and 26.—To show hæmatophagy and hæmetaboly by the epithelial cells, with assimilation for their own growth and nuclear increase; the cytoplasm contains pallid hæmoglobin-“vacuoles.” (As last; $\times 600$.)

FIGS. 27 to 30.—To show intranuclear hæmatophagy; hæmoglobin-“vacuoles,” pink-staining or pale, inside the nuclear membrane. (As last, except that fig. 28 is counterstained with van Gieson; $\times 600$.)

(To be continued.)

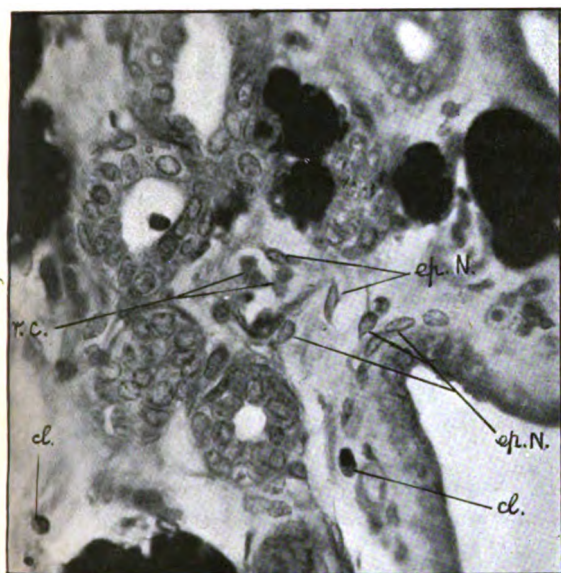


FIG. 1.

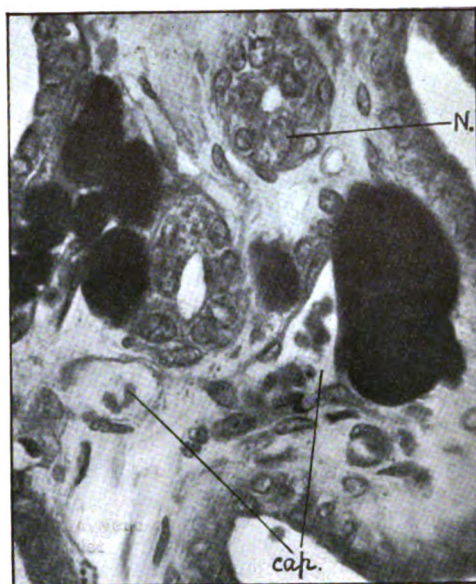


FIG. 2.

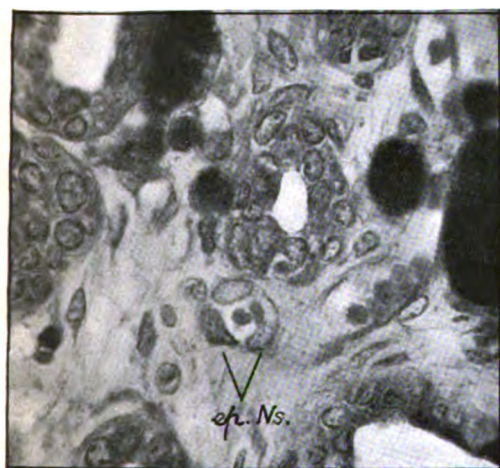


FIG. 3.

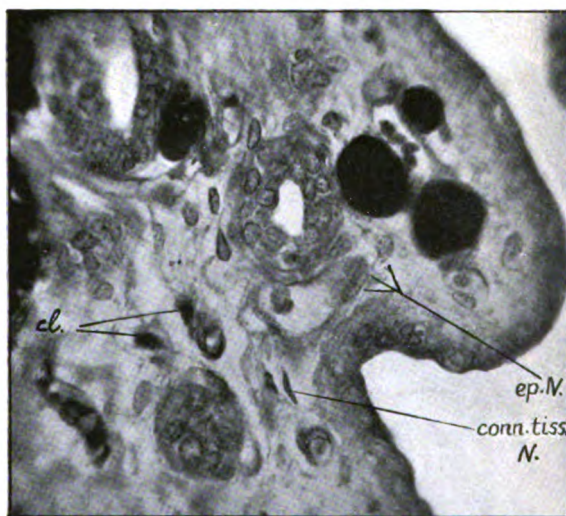


FIG. 4.

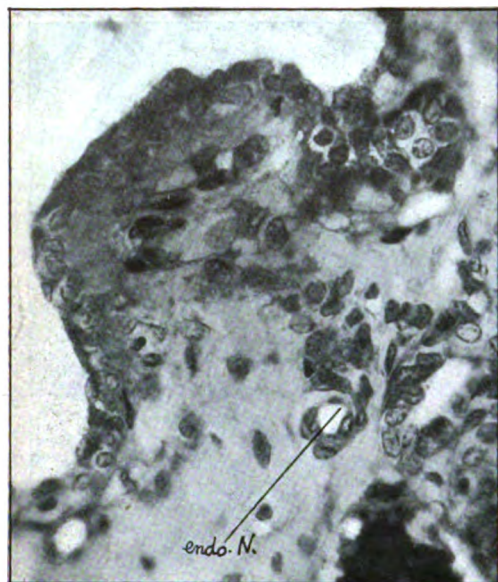


FIG. 5.

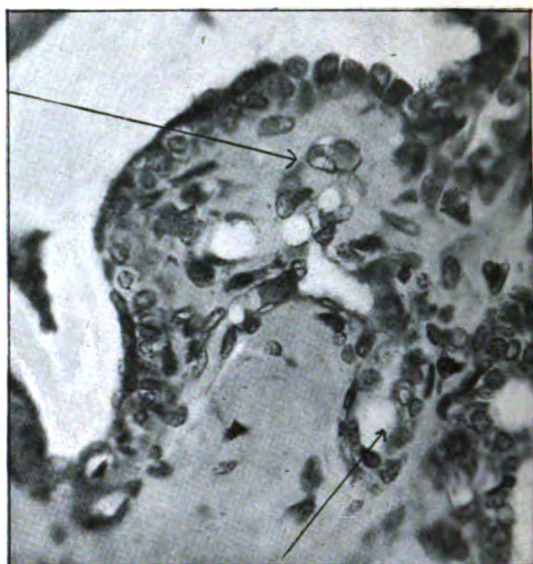


FIG. 6.

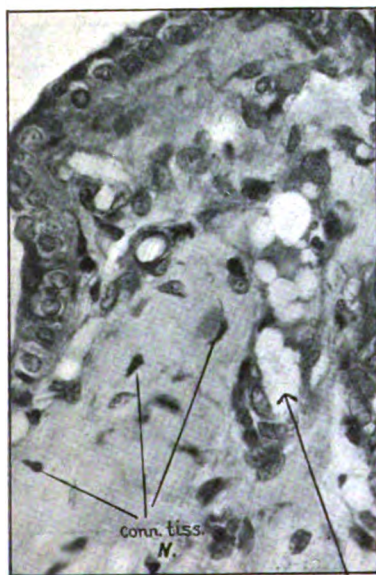


FIG. 7.

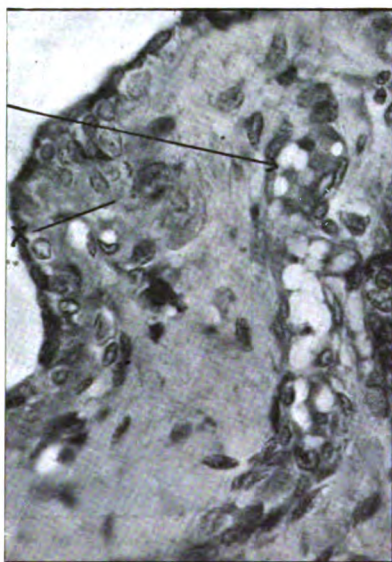


FIG. 8

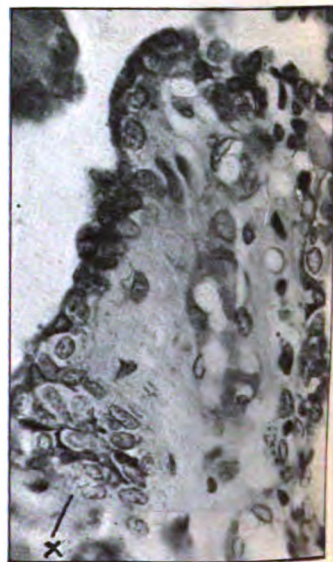


FIG. 9.



FIG. 10.

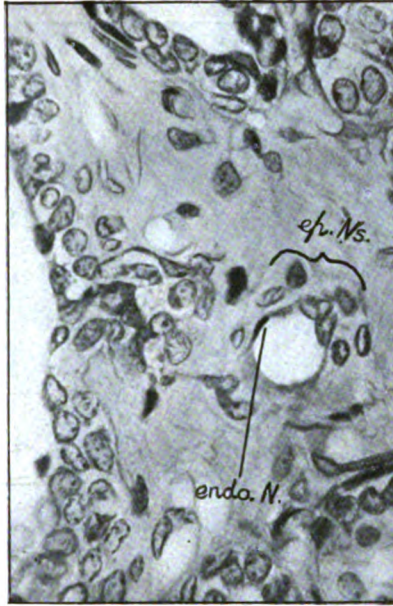


FIG. 11.



FIG. 12.

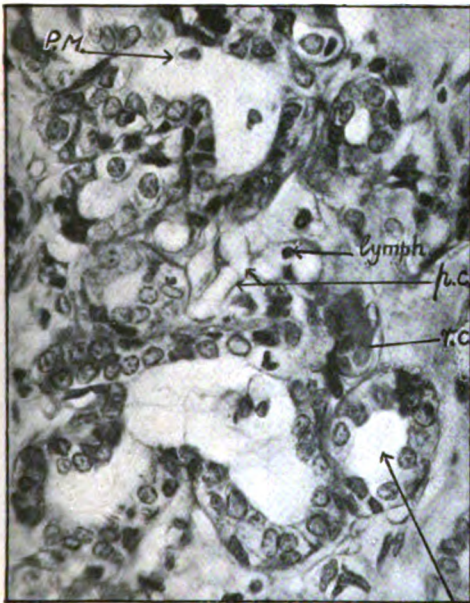


FIG. 13.



FIG. 14.

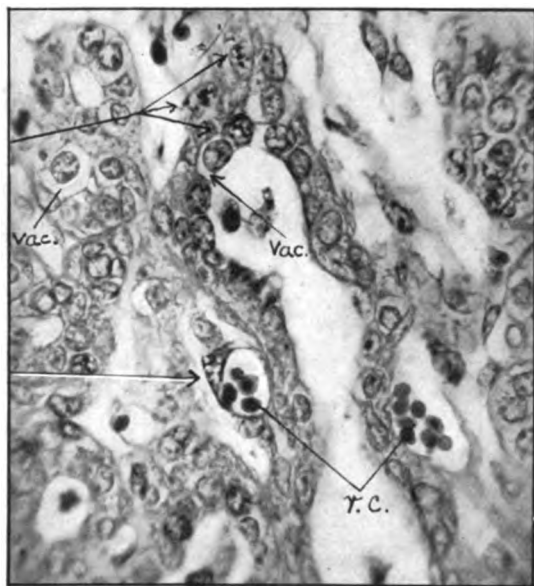


FIG. 15.

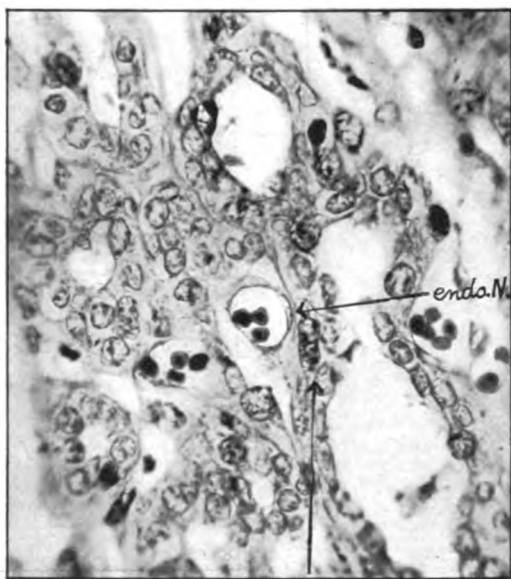


FIG. 16.

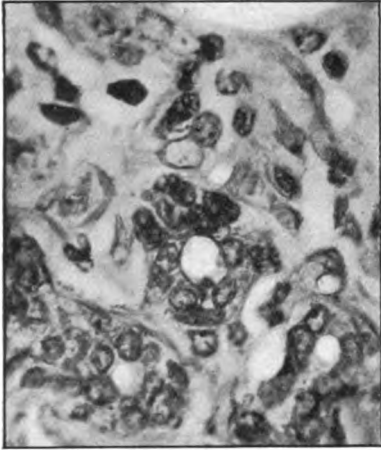


FIG. 17.



FIG. 18.

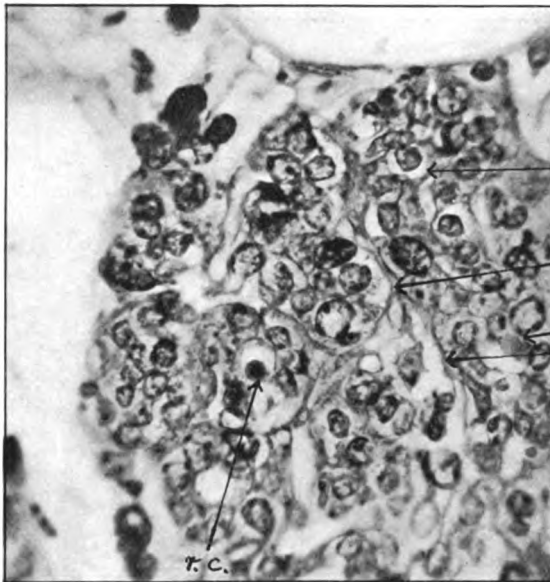


FIG. 19.

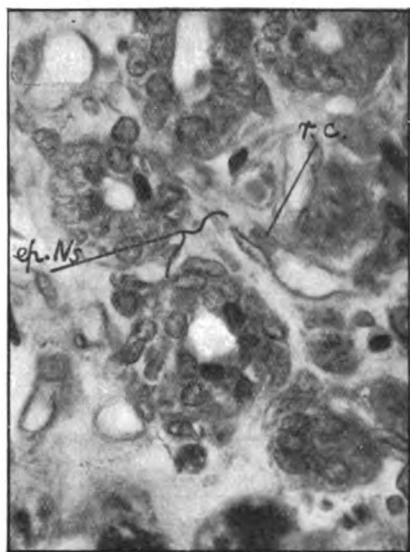


FIG. 20.

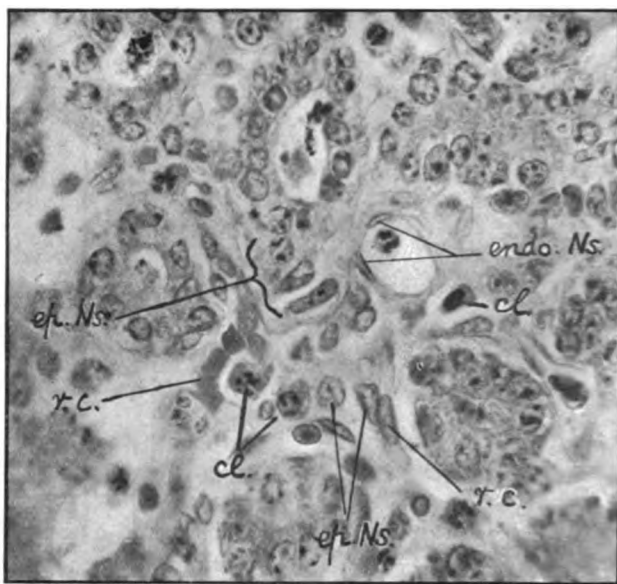


FIG. 21.

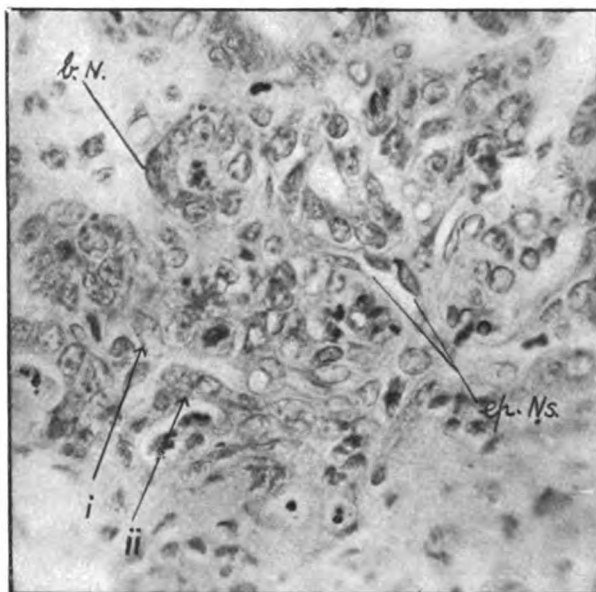


FIG. 22.



FIG. 23.

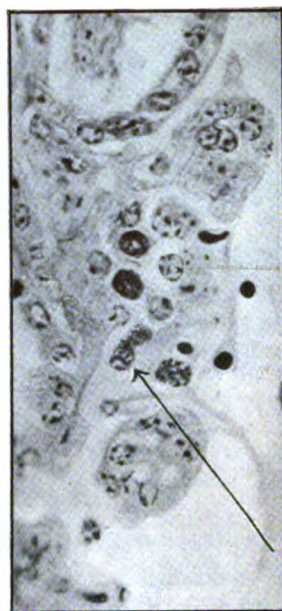


FIG. 24.

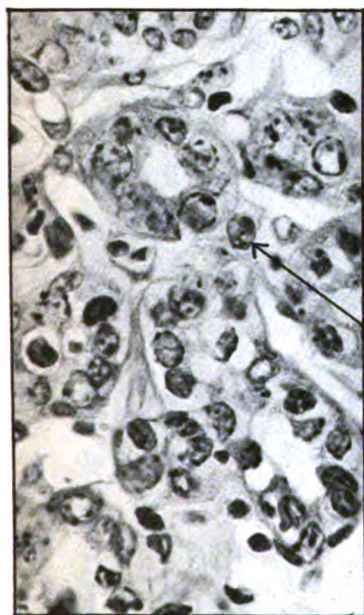


FIG. 25.

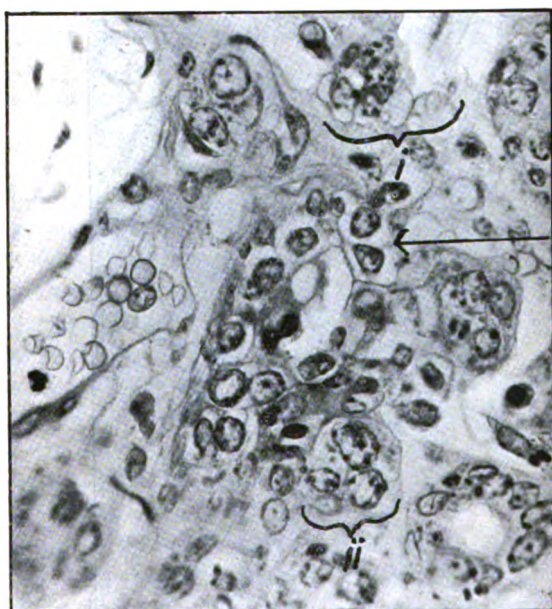


FIG. 26.

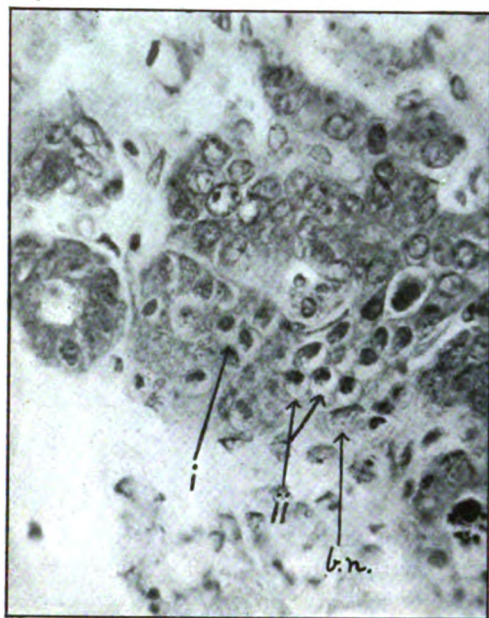


FIG. 27.

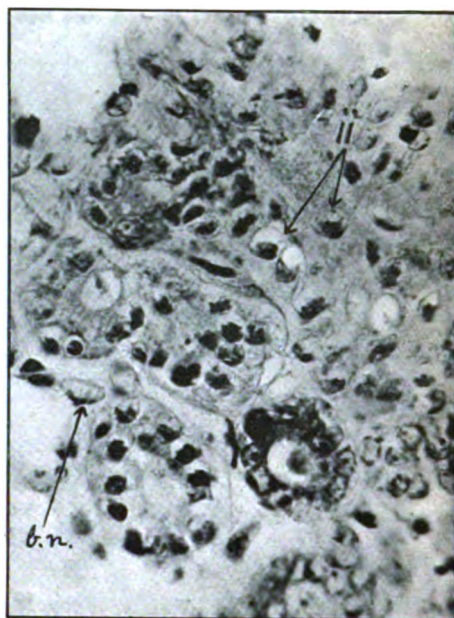


FIG. 28.

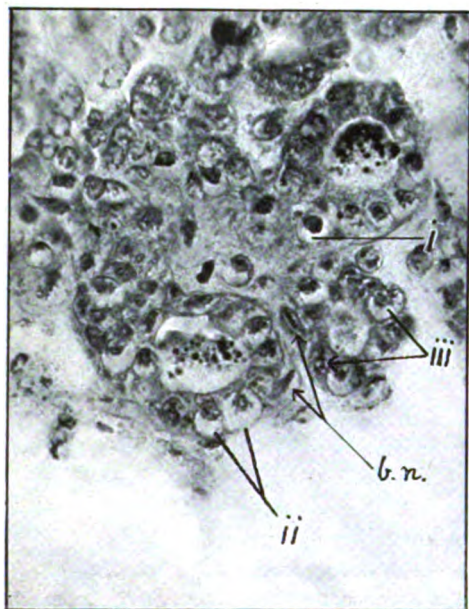


FIG. 29.

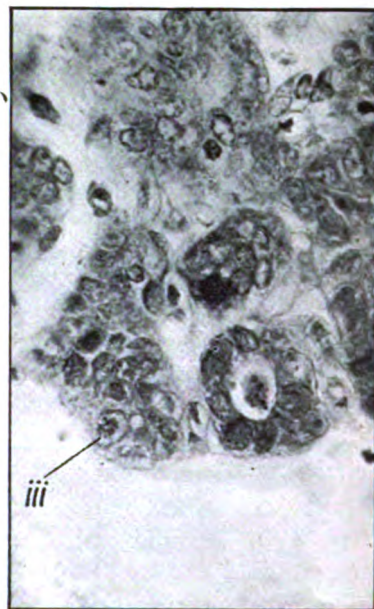


FIG. 30.

THE ESTIMATION OF HÆMOGLOBIN.

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THE usual method of clinically estimating the percentage of hæmoglobin in blood is by the use of one or other of the so-called hæmoglobino-meters. Of these the best known in this country are Gower's, Haldane's, von Fleischl's, Dare's, Oliver's and Tallquist's.

The principle on which all are based is the matching of the blood to be tested, either as whole blood or diluted with a suitable diluent, against a definite colour standard prepared to represent varying proportions of hæmoglobin.

In general they are simple in use, but their accuracy seems to be very uncertain. In preparing the various colour standards the makers disagree as to what proportion of hæmoglobin should be regarded as normal, and therefore what is supposed to represent 100 per cent hæmoglobin on one scale may be very different from what is given as 100 per cent on a scale of another type of instrument.

Again difficulties arise in the matching of colours. In some cases, owing either to some inherent properties of the blood under examination, or possibly due, as Lucey [1] points out, to some slight acidity of the diluent used, it is practically impossible to get the colours of the blood and standard to give a definite colour match, and one has to rely more on the density of the two solutions coinciding rather than the two colours matching. Moreover, colour matching is notoriously tiring on the eyes, as the retina quickly becomes exhausted and relatively insensitive to colours, and the personal factor has to be taken into account. In a series of cases on the same patients in which two of us (H.B.N. and J.W.S.) made parallel observations, using the Gower, Haldane and Tallquist methods, it was found that the results might vary by as much as ten per cent. Further, the cost of certain of the instruments, notably Oliver's, von Fleischl's and Dare's, is a drawback to their general use.

Another method which has been recommended for estimating the percentage of hæmoglobin is by the determination of the specific gravity of the blood, based on the fact that in many instances the specific gravity shows a close relationship to the amount of hæmoglobin.

We shall consider this question later.

More recently a method of estimating hæmoglobin has been introduced by Van Slyke [2] based on the measurement of the oxygen-carrying capacity of a measured quantity of blood.

This method appears to give, if carefully carried out, an absolute measure of the hæmoglobin content of the blood.

PERCENTAGE OF HÆMOGLOBIN IN NORMAL BLOOD.

The percentage of hæmoglobin in normal healthy individuals is usually taken as 100, corresponding to some 13·77 grammes of hæmoglobin in every 100 cubic centimetres of blood. It has been shown, however, that not only does the normal percentage of hæmoglobin vary between men, women and children, but even varies somewhat in amount in the same individual at different times of the day.

In order to find an average percentage of hæmoglobin for normal individuals a series of observations employing the Van Slyke method was made on fourteen healthy men and the results are embodied in the appended table. In order to obviate the variations recorded as dependent on food these observations were made on each occasion between the hours of 4 and 5 p.m., i.e., some three hours or so after the midday meal.

TABLE I.—HÆMOGLOBIN IN FOURTEEN HEALTHY INDIVIDUALS.

Number	Percentage	Number	Percentage
1	103·0	8	110·2
2	106·0	9	107·7
3	98·3	10	120·5
4	101·1	11	101·0
5	112·6	12	114·1
6	109·6	13	101·1
7	104·7	14	125·3
Average		108·2 per cent.	

It will at once be seen that different individuals vary enormously in their hæmoglobin content, a difference of twenty-seven per cent between the highest and lowest being observed. If one takes the average for the fourteen cases one gets the figure of 108·2 per cent.

It appears, therefore, that the old standard of 100 per cent representing 13·77 grammes of hæmoglobin per 100 cubic centimetres of blood is too low an estimate for normality and that in all probability a figure round 108 to 110 per cent more closely approximates to normal. This would represent some fifteen grammes of hæmoglobin per 100 cubic centimetres of blood.

Haden [3] in estimating the average hæmoglobin content of fifty-two normal individuals found it to work out at 15·6 grammes per 100 cubic centimetres. Other authorities, e.g., Meyer and Butterfield [4], and Williamson [5], give 16·6 grammes as the average normal content.

COMPARISON OF VARIOUS HÆMOGLOBINOMETERS.

In order to arrive at a conclusion as to the accuracy or otherwise of various hæmoglobinometers and to see if the results varied between the different instruments used, it was decided to do a series of examinations

of patients suffering from various diseases, using Gower's, Haldane's, Tallquist's, and von Fleischl's hæmoglobinometers, and at the same time to contrast the results thus obtained with the figures for the same patients obtained by Van Slyke's method. Throughout these examinations one of us (H. B. N.) did the Van Slyke method whilst H. G. W. was responsible for the figures obtained with the four hæmoglobinometers. In each instance the examinations were all done at the same time so as to avoid any possible error due to variations in the amount of hæmoglobin present at different times of the day and, in order to obviate colour fatigue of the retina, an interval of at least two hours was allowed to elapse between the examinations of two patients.

The results of these examinations on a total of thirty patients are set out in the appended table. (Table II.)

It should be mentioned in connexion with these cases that very few of them could be regarded as acute cases. Most of the Malarias and Dysenteries were cases who had had those diseases and been treated for the same, and were under observation to see if the infections were eradicated.

It will be noticed that no figures are given for the von Fleischl instrument in the last nine cases. This was due to breakage of the pipette of the instrument and our inability to obtain another.

TABLE II.

Name	Age	Sex	Disease	Gower	Haldane	Tallquist	Fleischl	Van Slyke
				Per cent	Per cent	Per cent	Per cent	Per cent
L. H.	36	M.	Pericarditis..	91	78	90	73	124.0
H. F.	28	M.	? Pernicious anæmia	17	18	20—30	15	23.4
S. K.	36	M.	Dysentery ..	51	51	70	42	50.6
D. B.	47	M.	Syphilis ..	72	74	90	51	83.4
H. S.	41	M.	Dysentery ..	100	82	100	78	105.2
F. S.	29	M.	Malaria ..	83	70	90	50	58.2
K. P.	38	M.	Dysentery ..	94	90	90	76	107.7
J. D.	33	M.	" ..	103	98	100	86	124.0
J. K.	15	M.	Septicæmia ..	80	78	70	66	94.6
L. R.	26	M.	Dysentery ..	106	104	80	97	125.4
J. O.	21	M.	" ..	97	92	70	86	108.0
B. A.	38	M.	" ..	104	100	80	92	115.0
C. H.	24	M.	? Malaria ..	103	94	70	82	118.0
F. H.	38	M.	Dysentery ..	93	82	70	64	111.7
P. S.	48	M.	" ..	108	92	80	87	118.6
H. G.	29	M.	Malaria ..	86	80	70	66	81.1
G. L.	50	M.	Sprue ..	75	60	70	67	83.6
F. B.	46	M.	" ..	94	90	80	71	117.7
S. W.	50	M.	" ..	39	38	40	27	48.4
T. D.	35	M.	Ankylostomiasis ..	88	75	70	61	90.4
C. A.	33	M.	Malaria ..	84	80	70	66	110.3
J. M.	35	M.	" ..	103	94	80	—	98.2
F. T.	28	M.	Sprue ..	71	66	70	—	77.8
G. C.	31	M.	Malaria ..	77	72	70	—	92.6
M. A.	33	M.	Dysentery ..	104	98	80	—	114.2
D. F.	32	M.	Jaundice ..	106	86	80	—	94.1
J. F.	29	M.	Dysentery ..	105	96	80	—	116.0
J. H.	26	M.	Malaria ..	84	78	70	—	100.3
G. M.	43	M.	Sprue ..	58	46	60	—	54.4
H. B.	20	M.	Dysentery ..	112	96	70	—	112.1

In studying this table it will at once be seen that not only do the figures obtained with the various hæmoglobinometers differ in most instances vary markedly from the figures obtained by Van Slyke's method, but also differ in many instances widely from each other.

Considering first the figures obtained with Gower's instrument as contrasted with those obtained by Van Slyke's method, we find that there is a variation ranging between 0·1 and thirty-three per cent. With Tallquist's hæmoglobinometer the variations show a range extending from 5·6 to forty-eight per cent.

With Haldane's apparatus again a very wide range of variation is to be noted extending from 0·4 to forty-six per cent.

With the Von Fleischl instrument figures as a rule are lower throughout than with the other instruments. This perhaps was only to be expected as many workers have commented on the colour scale of this instrument being set too low for the corresponding amount of hæmoglobin. Very marked deviation from the Van Slyke figures are therefore to be noted ranging from 8·2 to fifty-one per cent.

In comparing the various hæmoglobinometers used it will be seen that marked variation in the results recorded are to be noted, and it is quite an unusual occurrence to find two instruments agreeing in the examination of any particular blood.

Senty [6] has carried out a series of determinations of hæmoglobin, and has made a study of the results obtained by various instruments. He points out that Gower's instrument in his hands is only fairly accurate, that the standard colour tube rapidly fades and has the drawback that it is made of picro-carmin and not of blood, and consequently there is a difficulty in matching the exact colour.

With regard to Haldane's instrument he regards the results obtained as only fairly accurate and quotes Palmer as asserting that the standard tube is not permanent. He condemns the Tallquist method as inaccurate, and points to the disadvantage that the colours of the scale vary by ten per cent and so only an approximate value can be obtained.

Another disadvantage of this method we have noticed is that the colour-scale as prepared by different manufacturers of the instrument varies very considerably.

Senty, in his conclusions, states that the Dare instrument is satisfactory for hæmoglobin determinations from 20 to 65 per cent, but above 70 per cent the results are most misleading. He finds that the Tallquist hæmoglobinometer is practically as accurate as the Dare instrument.

THE SPECIFIC GRAVITY AS A MEASURE OF HÆMOGLOBIN.

It has been shown by several observers that commonly a close relationship exists between the amount of hæmoglobin and the specific gravity of the blood and some workers have taken this parallelism as a basis for calculating the hæmoglobin content.

It does not seem to be agreed, however, as to what constitutes a standard. Thus Hammerschlag gives the specific gravity of 1057 to 1060 as representing eighty-five to ninety-five per cent of hæmoglobin, whilst Lichty for a similar hæmoglobin equivalent gives the specific gravity as 1060 to 1063.

We have carried out the estimation of the specific gravity by the chloroform and benzol method on certain of our cases, and at the same time estimated the hæmoglobin by the Van Slyke method. The results are shown in the appended Table III.

TABLE III.—HÆMOGLOBIN AND SPECIFIC GRAVITY.

Case No.	Diseases	Hæmoglobin	Specific gravity
1 ..	Malaria	81.1 ..	1056—1057.5
2 ..	Sprue	48.4 ..	1041—1042
3 ..	Ankylostomes	90.4 ..	1058
4 ..	Sprue	77.8 ..	1057.5
5 ..	Malaria	92.6 ..	1059
6 ..	Sprue	54.4 ..	1047
7 ..	Healthy	120.5 ..	1065—1067.5
8 ..	Healthy	101.0 ..	1065—1067.5
9 ..	Diabetes	83.3 ..	1058
10 ..	Healthy	114.1 ..	1060
11 ..	Healthy	101.1 ..	1059
12 ..	Healthy	125.3 ..	1060
13 ..	Healthy	114.8 ..	1057.5
14 ..	Pyorrhœa	93.7 ..	1057.5
15 ..	?	114.1 ..	1057.5

From a study of this table it will be seen that although in a number of cases the specific gravity corresponds with the amount of hæmoglobin, as laid down by Hammerschlag, there are some notable exceptions, more especially in regard to those cases where the hæmoglobin value has been found to be high, 101 per cent and over.

It would appear, therefore, that the correlation between specific gravity and hæmoglobin content is not absolutely a constant from causes at present undetermined.

DAILY VARIATIONS IN THE HÆMOGLOBIN CONTENT.

Variations in the amount of hæmoglobin present in the blood of an individual at different periods of the day have long been noted.

Thus Oliver [7] states that the hæmoglobin rises with what he terms the “digestive lymph wave,” i.e., the to-and-fro intermediary circulation between the capillaries and the lymph spaces excited by the ingestion of food. He further states that immediately after a meal this wave begins to rise, and reaches its maximum in an hour, after which it steadily declines, and that the hæmoglobin curve follows the same course. This hæmoglobin curve would appear therefore to follow much the same course as the blood sugar curve. Dreyer, Bazett and Pierce [8] studied the question of diurnal variations in hæmoglobin percentage, and showed that these variations are very considerable, and may be as much as thirty

per cent while a variation of 10 per cent is a more or less common occurrence.

Rabinovitch [9] has also studied this question and publishes figures of twenty individuals in whom he estimated the hæmoglobin content by the Van Slyke method at intervals of two hours, from 8 a.m. to 6 p.m.

He shows that a variation as great as 26 per cent was noted in two instances. In four cases the variation ranged between 15 and 20 per cent, and in six cases between 10 and 15 per cent.

It will be noted in studying his figures as given for the 12 noon and 2 p.m. examinations, between which hours it is reasonable to suppose the individual under examination partook of his midday meal, that in fourteen instances the hæmoglobin showed a fall, thus not conforming to Oliver's dictum that with the active digestive wave the hæmoglobin rises.

We have carried out a series of observations on six individuals taking estimations of the hæmoglobin by Van Slyke's method, blood sugar by Maclean's method and specific gravity at 12 noon, at 2 p.m. (one hour after midday meal) and again at 5 p.m. (four hours after midday meal), and the results are appended in Table IV.

It is to be regretted that the series is not larger, but it is difficult to find volunteers willing to allow you to put a needle into a vein three times in the one day.

It should be mentioned that all the cases are of adult males and all healthy individuals except Case 1, who, although active and doing his full day's work, was receiving insulin treatment.

TABLE IV.—HÆMOGLOBIN, SPECIFIC GRAVITY AND BLOOD SUGAR.

Case No.	12 noon			2 p.m.			5 p.m.		
	Hæmo-globin	Specific gravity	Blood sugar	Hæmo-globin	Specific gravity	Blood sugar	Hæmo-globin	Specific gravity	Blood sugar
1	76·06	1065-1067·5	0·17	90·5	1059	0·20	83·3	1058	0·17
2	106·4	1059	0·118	99·0	1059	0·18	101·3	1059	0·12
3	121·5	1060	0·093	116·6	1060	0·12	114·1	1060	0·016
4	118·0	1060	0·125	115·6	1060	0·15	125·3	1060	0·160
5	114·8	1057·5	0·125	112·4	1057·5	0·156	114·8	1057·5	0·175
6	125·0	1057·5	0·106	127·6	1059	0·118	120·4	1057·5	0·131

It will be noted that of these six cases only two showed a definite rise in the hæmoglobin content, when it may be presumed the digestive wave was at its height.

Of these few cases the maximum variation noted was fourteen per cent.

We are greatly indebted to Dr. Low and Dr. Manson-Bahr, Physicians to the Hospital for Tropical Diseases, for kindly permitting us to utilize many of their patients for this investigation.

CONCLUSIONS.

(1) The standard of 100 per cent representing 13·77 grammes of hæmoglobin per 100 cubic centimetres of blood as used in the Gower, Haldane, Fleischl and Tallquist hæmoglobinometers is probably too low.

(2) The normal standard would appear to be about 108 to 110 per cent, representing some fifteen grammes of hæmoglobin per 100 cubic centimetres of blood.

(3) The four instruments above mentioned are unreliable for measuring the hæmoglobin content of the blood.

(4) Inasmuch as the hæmoglobin content of the blood in any individual varies during the day, it is important in making comparative estimations on the same individual to take the blood at approximately the same hour on each occasion.

(5) Although in many cases the specific gravity of the blood closely corresponds to the amount of hæmoglobin present this method cannot be regarded as a reliable one in all cases for the estimation of the hæmoglobin.

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RADIOLOGY (IN ARDUIS FIDELIS).

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Royal Army Medical Corps.

(Continued from p. 119.)

THE DARK ROOM.

(a) *Darkness.*—The dark room should be all that its name implies.

Unsafe lighting must be guarded against.

Dark room illumination should be tested as follows:—

Unpack a film in darkness on the loading bench, placing on it two or three coins or similar opaque articles, and expose to the dark room light for five minutes.

Develop this film under normal working conditions, but in total darkness.

If an image of the opaque articles is visible, the density of the developed fog is an indication of the extent of the fogging action of the defective illumination.

Direct inspection of the room in the dark will reveal any white light leakage.

The dark room entrance should have double doors or some "light lock."

The illumination of the dark room should be reflected light from the ceiling and walls. The ceiling should be whitened and the walls painted a light buff or cream colour.

Running water should be available.

The developing section should be separate from the loading section and the loading bench must be kept perfectly dry and should be protected from splashes.

A film cabinet under the loading bench is of value.

The film storage cabinet should have sufficient lead protection and this should be of sufficient thickness to keep super-sensitive film immune from X-radiation, even when it is loaded between two intensifying screens.

Efficient ventilation should be provided.

Absolute cleanliness and tidiness are essential.

The floor of the room should be mopped and never swept.

Any moisture on the floor or tables must be mopped up immediately development is finished.

The operator should wash his hands frequently, and dry them thoroughly.

At least seventy-five per cent of bad results are due to faulty work in the dark room.

Economize space in the dark room and ensure rapidity and accuracy by maintaining a definite order of working.

The arrangement of the various sections reading from left to right should be as follows:—

(1) Loading and unloading bench.

(2) Developing tank.

(3) Rinsing tank.

(4) Fixing tank.

(5) Washing tank.

(6) General sink above which the film negatives are suspended for drying.

(7) Dry bench for sorting and printing operations.

(b) *Development*.—The temperature of the developer is the all-important factor, and should be most carefully attended to (*vide* "Temperature Co-efficient of Developer").

As far as possible, all solutions used in the process of developing, washing and fixing should be of the same temperature. The developer has certain characteristics:—

(1) *The Reducer* (or the Developer).—The best reducers are "metol" which is a fast developer, and "hydroquinone" which is a slow developer. Metol is active in producing detail, while hydroquinone is active in producing contrast. The combination of these two is the developer most used, and is called "metol-hydroquinone."

(2) *The Accelerator*.—To enable the developer to penetrate the emulsion, an alkali—usually carbonate of soda—is added which opens the pores of the gelatine.

(3) *The Preservative* is the added chemical, which prevents undue oxidation of the developer. A stale developer is discoloured and is very weak in action. Sodium sulphite has a great affinity for oxygen and is the usual preservative.

(4) *The Restrainer* prevents too rapid action of the developer. Over-action might even affect the unexposed silver salt, thus causing fogging. Potassium bromide is the usual restrainer used.

(5) *The Solvent* is distilled or boiled water; as the developer acts, the solvent takes up used developer and allows fresh developer to attack the emulsion.

Methods of Development.—Development can be carried out by three methods:—

(1) *Tray*.—This is the most difficult method, and for its practice the routine is:—

(a) Temperature of developer 65° F.

(b) Standard time.

(c) Rock the tray continuously.

(d) Keep the trays distinct from each other always.

(e) Wash the trays, before and after using.

(f) Keep the hands scrupulously clean.

(g) Use sufficient developer to cover the film at least half an inch.

(2) *Factorial*.—The time of the first appearance of the image has a fixed relation to the total time necessary for full development. Time the interval from the immersion of the film until the first sign of the image appears.

An almost imperceptible darkening here and there will be seen on the plate.

Note this time and multiply it by the factorial number for the developer used, and the result will be the number of seconds required for full development.

The disadvantages are that a careful watch has to be kept, and this means exposing the film to the ruby light, just when it is in a highly sensitive condition.

(3) *Tank*.—This is the ideal method and requires :—

- (a) A standard strength of developer.
- (b) Action of the developer for a standard length of time.
- (c) Action at a standard temperature.

It is essential that all films be developed for the same length of time, regardless of exposure.

The exposure can then be corrected and in time will become standard for the particular tube working.

The advantages are :—

- (a) Simplicity in working.
- (b) Uniform results, when exposures are standardized.
- (c) Everything on an under-exposed film is brought out, and the temptation to over-develop is removed.
- (d) Everything on an over-exposed film is brought out, and although the result is very dense, yet it is full of contrast and detail and can be reduced.
- (e) Reduces the risk of light fog. The film is left in the solution until it is ready.
- (f) The results have proved the value of the method. It is given to few to have that sense of judgment required to decide the stage of development in a film as seen in the ruby light of the dark room, the mechanical nature of the method removes all elements of human error.

Method of Tank Development.—Do not wet the film before placing it in the developer. Put it direct into the tank without commotion of the fluid. There is no necessity for rocking.

Leave it for five minutes.

The solution must be at 65° F. and should be kept at that temperature throughout. *Wash. Fix. Wash. Dry.*

Other Remarks re Development.—Most radiographers have a tendency to under-develop.

A negative may appear correct in the dark room under the ruby light and yet be under- or over-developed.

A trace of hyposulphite of soda in the developer will affect its working qualities.

All developers deteriorate with the lapse of time :—

(1) From oxidation in the air—therefore keep the developer covered, and as far as possible “air-tight.”

(2) From the oxidation caused by the contained oxygen content of the water. Always use distilled water, or at the very least boiled water, for making up the developer.

A negative may be considered *good* if the radioparent parts of the subject give opacity or density, and the radiopaque parts of the subject show varying degrees of transparency in the negative.

With correct exposures radioparcencies appear first in the development, then the half-tones and then the details in the radiopacities.

Do not stop developing because the radioparcencies "grey over"; this is commonly mistaken by the novice for "fading away of the image."

A properly exposed film developed for too short a time has the appearance of being under-exposed and lacks contrast.

A properly exposed film developed for too long a time has the appearance of being over-exposed and lacks both contrast and detail and shows fog and stains.

Under-exposure.—If the image takes time to appear and the radioparcencies come up with the brighter half-tones, pour off the developer and flood the film with water. Dilute the developer with an equal quantity of water and continue until all possible detail is out.

If the film is obviously under-exposed, the time of development may be lengthened but never more than two minutes from the normal.

Over-exposure.—If the images flash up rapidly and all parts come out quickly, pour off the developer and use developer with less accelerator alkali.

(c) *The First Washing.*—Immediately after development the film should be thoroughly rinsed in fresh running water for about one minute.

(d) *Fixation.*—Immediately after washing the film should be placed in the fixing bath for about five to ten minutes, or about twice the time it takes for the milky appearance to disappear completely.

An acid fixing bath is best. The chief ingredient is hyposulphite of soda. Alum may be added to harden the gelatine. The solution is acid to neutralize the alkaline developer as rapidly as possible.

The acidity of this solution should be tested from time to time.

The purpose of fixation is to remove the remaining silver salts.

The fixing bath can be considered stale whenever it takes half as long again to fix standard films, as when it was new. It should then be thrown away.

Do not add fresh "hypo" solution to the stale fixer.

The fixing solution should never be stronger than a maximum of six ounces of hyposulphite of soda to the pint of water. Discoloration of the "hypo" solution is due to oxidation of the developer, which has been dissolved out in the process of fixing.

(e) *Washing the Second.*—Immediately after fixation the film should be washed in fresh running water for twenty minutes or more.

Note.—In these transferences from solution to solution, a film must

never be transferred from a cold to a hot solution, as chemical fog or stain will result. "From hot to cold" should be avoided if possible, but is not so important.

(f) *Drying*.—Immediately after the second washing, the film should be hung up to dry. The room should be at a uniform temperature and the atmosphere dust-free.

Summary of Development.—A fresh film, free from light-fog, dust, friction or abrasion marks, kinks, unloaded, and developed in a safe dark room: developed for five minutes at 65° F. in a fresh, clean developer made of chemicals of the proper quantity and quality dissolved in distilled water; rinsed one half minute in clean fresh running water at or slightly below the temperature of the developer; fixed for ten minutes in clean, fresh hypo solution made with chemical of the proper quantity and quality, and the bath at or slightly below the temperature of the washing water; washed for twenty minutes in clean fresh running water at or slightly below the temperature of the fixing solution; dried at a uniform rate in an atmosphere free from contamination, especially dust; handled altogether by the edge or corners to prevent finger marks.

Intensification.—This is rarely advisable or successful, as detail, which is not there, cannot be intensified.

In the rare cases where intensification is practised, the negative should be well fixed and thoroughly washed, then immersed in bichloride of mercury 200 grains, bromide of potassium 200 grains, water to ten ounces until it is bleached right through to the back. The film should then be washed carefully and placed in sulphite of soda half ounce, water to four ounces, leaving it there until full density is obtained. Wash and dry.

Reduction.—Negatives which are too dense all over, due to over-exposure, with or without over-development, should be reduced by means of Farmer's solution. The action of such a solution is to attack the metallic silver resulting in an image of lesser density.

The most over-exposed films will give beautiful results after treatment, therefore if, during development, the image flashes up, do not be afraid to leave it there even for five minutes, it will always reduce well.

If the films are dry, soak them for an hour before commencing.

Farmer's method:—

Solution No. 1—Hyposulphite of soda	...	...	1 oz.
Water	...	...	to 16 "
Solution No. 2—Potassium ferricyanide (red)	...	...	1 "
Water	...	...	to 16 "

Keep solution No. 2 in a dark bottle in the dark room when not in use, as it rapidly decomposes under the influence of light. At the moment when required, mix eight ounces of No. 1 with one ounce of No. 2 or weaker if necessary, as reduction is very apt to be quick and overdone. The process should be carried out in a subdued light. When a negative is too dense in parts these can easily be reduced by applying the reducing solution with a tuft of cotton, and gently rubbing until the desired reduction is attained.

Wash frequently during the operation. Dry.

Printing.—The work of the radiographer and occasionally the standing of the radiologist, is judged by the quality of the prints submitted to other departments.

Hence it is essential, that if a print is produced it must be the finished work of an expert, well finished, highly glazed and suitably mounted.

There are three methods of printing in everyday use :—

(1) Printing out paper (P.O.P.). This is a gelatino-chloride paper, the silver salts are in an emulsion of gelatine on the surface of the paper. The stronger the light used, the flatter will be the contrast in the print, so the exposure should be in weak daylight. Sunlight should not be used. All daylight should be excluded in the handling of the print, before it is fixed. Full instructions are usually supplied with the packets for the most suitable form of toning process.

(2) Bromide paper. This is printed by artificial light and is more generally useful. The paper is exposed, developed and fixed according to the manufacturer's printed instructions.

(3) Gas-light paper. This is a slow bromide paper.

Glazing and Mounting.—Prints should be well hardened in alum or formalin, and then placed direct from the subsequent washing water on to clean and chalked plate glass or ferro-type. Lay the glass or ferro-type on a firm table and squeeze lightly with a roller squeegee over fluffless blotting paper. Leave the print in actual contact with the glass until dry, when it can be stripped off by inserting a knife under the edge of the print. It is then ready for trimming and mounting.

Enlargement.—In radiography this is seldom necessary. The original negative is placed in a special projecting lantern and the image is projected on to a sensitive plate, film or paper.

Lantern Slides.—A lantern slide is usually a positive transparency on a glass measuring $3\frac{1}{4}$ by $3\frac{1}{4}$ inches, and is useful for illustrating lecture demonstrations. A lantern slide is printed by contact or projection. The former when the negative is of the same size, or when only a portion of a larger negative is required; the latter, when a reduced image of a larger negative is required. These original reductions can be "printed" into negative transparencies, by contact, if the final projection on the screen is to be similar to the actual appearances of the negative in the viewing-box. The procedure and developing formulæ for lantern slides is always given in detail on each packet of plates.

Clinical Photography.—The radiographical departments of military hospitals should be equipped with ordinary photographic cameras and materials, so as to be able to provide photographs of such special clinical cases, as are worthy of permanent record, "before," "during" and "after" treatment. This would be of value for all the departments of the hospital, and would conceivably add to the value of case records.

(To be continued.)

CONFIDENTIAL REPORTS.

By MAJOR-GENERAL C. E. POLLOCK, C.B., C.B.E.

ANNUAL confidential reports are again nearly due. Conscientious senior officers look forward with gloomy foreboding to this, perhaps the most difficult and disagreeable of all their duties.

The report has to embody the Commanding Officer's opinion of the officer's work and capacity during the past year while serving under him. Much thought is required in order that the opinion may be expressed clearly in a few lines. It must be borne in mind that the report has not merely a passing interest but it is filed with the officer's personal papers and becomes a permanent record which is dragged into the open and carefully scrutinized on each occasion that the officer's name is considered for promotion or for any special appointment. It may occasionally happen that no member of the Selection Board has personal knowledge of the officer, and his merits have to be judged entirely from his confidential reports. King's Regulations, paragraph 213, stresses the importance of this aspect of confidential reports.

All officers cannot be equally proficient, and it is the duty of the reporting officer to discriminate between them, taking care that the keen officer receives adequate acknowledgment, while the gentleman who complies with regulations without taking any remote risk of a breakdown from overwork may be dismissed with a brief note to the effect that his work and conduct do not call for any special mention.

When making visits or inspections, Administrative Officers should carry a confidential notebook, giving a separate page to each officer's name. Any points concerning an officer or his work should be noted and dated at the time, not forgetting those which reflect credit on the officer. Should it unfortunately be considered necessary to make a note of any dereliction from duty, the offender should be informed that this is being done and will be taken into consideration when writing his confidential report, by which time the offence will probably not seem so serious, and the reporting officer will have had time to remember that he also was young once. A perusal of these notes will help enormously when compiling the annual confidential reports and assist in answering criticisms.

The actual wording of the report is by no means easy. The reporting officer should bear in mind that the real purpose of the report is to help the higher authorities to select the best men for special appointments and for promotion. The number of very senior appointments in the Corps is limited, and therefore only those officers who possess outstanding merit can be selected to fill them.

The confidential report should therefore give a word picture of the officer's attainments and character, which would guide the Selection Board when considering names submitted to them. If the reporting officer chooses the path of least resistance and gives every officer a glowing report, merely varying the adjectives with the help of a dictionary, he may save himself some small worry in the way of correspondence, but he also inflicts great injustice on keen officers, and possibly on the Corps, by assisting an officer of mediocre qualifications to reach the higher ranks. At the same time he does not add to his own reputation as an able and courageous administrative officer.



Clinical and other Notes.

COLLOIDAL THERAPY IN MILITARY MEDICAL PRACTICE.

BY CAPTAIN H. G. WINTER, M.C.

Royal Army Medical Corps.

THE following notes on a series of cases treated at the Officers' Hospital, Abbassia, Egypt, with various colloidal preparations, may be of some interest.

The number of cases treated is small because only small quantities of these drugs were obtainable, but the results were encouraging.

With the exception of the manganese butyrate, all the drugs used were Crookes' preparations. All appeared to be stable and keep well, even in this country.

The following table gives the particulars of drugs used, cost (including overhead charges), numbers treated, etc. :—

Name of drug	Number of patients treated	Average cost per patient		Average cost per patient per day		Total cost		
		s.	d.	s.	d.	£	s.	d.
Collosol manganese (double sol.)	11	0	8·18	0	0·50	0	7	6
Manganese butyrate ..	12	0	3·75	0	0·39	0	3	9
Collosol sulphur and collosol iodine combined	3	4	3·00	0	1·44	0	12	9
Collosol calcium ..	2	3	6·00	0	1·90	0	7	0
Collosol argentum ..	1	3	0·00	0	3·00	0	3	0
Collosol sulphur cremor ..	2	0	8·00	0	1·14	0	1	4
Collosol argentum ointment ..	1	1	10·00	0	0·68	0	1	10
Totals ..	32*	1	4·28	0	1·04	1	17	2

* Of these, ten were in-patients and twenty-two out-patients.

Commenced treatment of first case ..	December 3, 1923	} Equals 180 days.
Statement up to ..	May 30, 1924	

For comparison, the following are averages in this country for drugs and dressings only as worked out by the Corps of Military Accountants :—

Average cost per out-patient per diem, 2d.
Average cost per in-patient per diem, 5d.

The drugs which gave the best results and which it is considered are best suited to military medical practice are the collosol manganese and manganese butyrate. The therapeutic results were the same with both, but in view of the cost and the time under treatment, the latter is undoubtedly to be recommended. The cases treated were all types of coccus infections, furunculosis, impetigo, lymphadenitis, acne vulgaris, carbuncle, non-gonococcal urethritis, etc.; many of the cases had already had one and sometimes two courses of autogenous vaccines. Appropriate local applications, i.e., fomentations, ointments, etc., were used in conjunction with these drugs. The results obtained were exceptionally good.

Next in order were the collosol sulphur and collosol iodine. One case (a N.C.O., C.M.A.) suffering from long-standing fibro-myositis was greatly improved and went through the first winter for many years without pain. He has now purchased further supplies for himself as no more can be given him. The second case, suffering from muscular rheumatism, was cured and was clear of any symptoms for four months. This patient, a senior officer, had a recurrence four months after ceasing treatment; he has proceeded home on leave and is purchasing further supplies. The third case, an officer with acute myositis, was improved but not cured as supplies ran short in the middle of the treatment.

Cases treated with collosol argentum, collosol sulphur cream or collosol argentum ointment did not appear to derive much benefit except one very long-standing and resistant case of sycosis barbæ, which was improved but not cured with collosol argentum ointment.

Collosol calcium was used in one case of ischio-rectal fistula and in one case of tuberculosis. In the latter disease a certain amount of improvement was observed and, although the disease was very advanced, the night sweats were kept in check and the amount of blood in the sputum was reduced.

The collosol manganese and manganese butyrate were given by intramuscular injection, collosol calcium by subcutaneous injection, collosol sulphur by the mouth, collosol iodine by the mouth and intravenously, and the remainder as local applications. With the exception of some stiffness in the sites of injection, no toxic manifestations were observed in any of the cases.

It has been found that a large number of cases of sickness causing absence from duty for short or long periods, especially in a country such as this (Egypt), are due to septic skin infections caused by dirt, mosquito bites, and debility resulting from climatic conditions. These infections are rapidly cured and the period under treatment and consequent loss of efficiency are greatly lessened by the manganese preparations.

The author strongly advocates the addition of one two-cubic-centimetre Record syringe with suitable needles for intravenous, intramuscular and subcutaneous injections, to the equipment of every medical inspection room, and that supplies of manganese butyrate be made available from Army Medical Stores.

The technique is simple and can be easily carried out in the medical inspection room. The syringe and needles need never be boiled but should be kept suspended in a mixture of equal parts chloroform, lysol and rectified spirit, and are then sterile. When required for use they can be taken out and put in plain spirit. A glance at the table shows that the cost is well below that incurred by the ordinary methods of treatment.

In addition it is considered that other collosol products, especially the sulphur and iodine, should be available for use in military hospitals in suitable cases.

Although, perhaps, not strictly coming within the scope of this article, the author desires to put in a plea for the greater use of the syringe in treatment in the Army. Every year, more and more drugs are being put up in forms suitable for injection. In the author's opinion the advantages greatly outweigh the slightly disagreeable nature of the treatment. The dosage is more certain and more easily controlled, the action quicker and there is less likelihood of digestive disturbances than when given orally. As an example, cases at this hospital when convalescent after fevers, etc., are given a tonic of glycerophosphates, cacodylates of soda and strychnine sulph., subcutaneously, and their period in hospital and absence from duty greatly shortened in consequence.

I am greatly indebted to Colonel W. H. S. Nickerson, V.C., C.B., C.M.G., D.D.M.S., B.T. in E., and Colonel H. Ensor, C.B., C.M.G., D.S.O., R.A.M.C., S.M.O., Abbassia, and O.C. Officers' Hospital, for obtaining authority for the local purchase of the drugs used and for permission to publish these notes.

PRELIMINARY REPORT ON THE RESULTS OF INVESTIGATIONS INTO THE CAUSATION OF BLACKWATER FEVER IN SOUTHERN RHODESIA.

PRESENTED TO THE LEGISLATIVE COUNCIL, 1923.

By J. G. THOMSON, M.B., Ch.B.

Director of Protozoology at the London School of Tropical Medicine.

IN all parts of the world where pernicious malaria is rife, blackwater fever occurs. On the other hand, in those countries where only benign tertian occurs, blackwater fever is unknown. Clinically, pernicious malaria in Southern Rhodesia varies enormously. In one type, the clinical symptoms may not be severe, but the disease is active, more or less chronic, with gradually progressive anæmia. A more or less continual hæmolysis goes on; the liberated hæmoglobin is dealt with by the liver and converted into bile pigments, and during this stage the only manifestations of free hæmoglobin are biliousness, anæmia and bilirubin in the urine. There is at this stage of the malaria no hæmoglobin in the urine, but bile may occur simulating blackwater. All these cases of pernicious malaria of a chronic character might suitably be termed pre-blackwater.

An analysis of the hospital statistics for Southern Rhodesia for the ten years ending 1922 shows 6,608 admissions for malaria, and 492 for blackwater fever; the curves of these two diseases conform very closely, rising and falling together in a striking way. The worst months for blackwater fever are April, May and June, as it is during these months the full effects of malaria occur, and the sudden drop in the incidence of blackwater during the months of July, August and September corresponds in a remarkable manner with the diminution of malaria and the disappearance of mosquitoes.

In all the cases (23) of blackwater fever examined before the onset of hæmoglobinuria *Plasmodium falciparum* was found in the blood. With the onset of hæmoglobin the parasites usually disappeared in one or two days. Many cases examined after the onset showed no parasites in the peripheral blood, but all post-mortem examinations obtained in such cases showed definite evidence of malaria.

No difference could be detected in cultures of parasites from cases of malaria and blackwater fever.

Crescents are comparatively rare amongst adult natives and adult Europeans, but are extremely common amongst native children and also in young European children. Out of 100 native children whose blood was examined on one occasion almost 40 per cent showed the presence of crescents. By far the most important carriers of malaria are therefore the children, an important point in reducing the malarial incidence.

The remarkable co-relationship of the incidence of malaria to blackwater fever, and the parasitic findings, together constitute overwhelming evidence that the causal organism of blackwater fever is the pernicious type of malarial parasite.

Echoes of the Past.

INTRODUCTORY LECTURE DELIVERED TO THE CLASS OF
MILITARY SURGERY IN THE UNIVERSITY OF EDINBURGH,
MAY 1, 1855.¹

By SIR GEORGE BALLINGALL.

Regius Professor of Military Surgery.

(Continued from p. 302.)

With reference once more to this "civil element," for which we are indebted to his Grace the Duke of Newcastle, I would observe, that the expression is somewhat indefinite; and as we are not told how far it is to be carried in the re-organization of the medical department, I would say that if this element must be introduced into the department, it should be at the bottom, not at the top of the tree. I wonder what civil element actuated Larrey when he killed the spare horses of the officers to make soup for his men. This you will allow was a most uncivil proceeding; but for this, Napoleon made him, on the instant, a Baron of the Empire. The highest prize in the medical department ought to be accessible to the youngest assistant surgeon who enters the service; and a very paltry prize it is for this great country to hold out to the Chief Medical Officer of its army.

¹ From an old book kindly lent by the late Dr. George Ballingall, St. Leonards-on-Sea.

The experiment of introducing the "civil element" into the medical department of our army, has heretofore been eminently unfortunate. Let us revert for a moment to the calamities of Walcheren. There was at that time a respectable old gentleman from civil life at the head of the department, the late Sir Lucas Pepys, who had, I believe, been a successful apothecary, or general practitioner at Weymouth, and had made himself acceptable to George III., when resident there. When called upon to proceed to Walcheren to give his assistance to the sick, he declined to move, sat still in Berkeley Street, and declared in an official communication, that he could be of no use, and that he knew nothing of camp and contagious diseases but what he had learned from Sir John Pringle's book. To this, it was said by Cobbett, a great political writer of the day, with all the bitter irony of which he was so great a master, that the old gentleman had only one additional declaration to make, that he was unable to draw his salary.

On another occasion, when the ophthalmia spread far and wide amongst the soldiery in this country, after the return of the army from Egypt, when the civil part of the population became alarmed for their eyesight, and when an enormous burden had been thrown upon the public by the number of men pensioned for blindness, a distinguished oculist from civil life, the late Sir William Adams, was placed at the head of a large and expensive ophthalmic hospital in the Regent's Park; what was the result? "It cannot," says Dr. Vetch, "fail to surprise every impartial mind to observe, that even from the report of Sir William Adams himself, so far from effecting a national saving of £60,000 per annum, which he had promised, by a reduction of the ophthalmic pensioners, *not one has been sufficiently benefited to admit of his pension being either reduced or taken away*; and of six soldiers included in the report, all of them, cases of opaque cornea, combined with the second stage of Egyptian ophthalmia, *not one has been rendered fit for duty, and all have been added to the list of pensioners*." It is, most assuredly, not with any idea of under-rating the attainments of my many eminent friends in civil life that I express myself thus strongly, but for the purpose of deprecating what I consider an injustice to the medical department of the army.

It is not, Gentlemen, I repeat, from the want of able and intelligent men among the staff and regimental surgeons serving in the army of the Crimea, that that army has in any degree suffered. The want of that army, as of many others, has been in the inferior ranks, indeed in the very lowest grade of the attachés to the medical department—the want of a numerous and efficient hospital corps. In so far as some of the duties of such a corps have been zealously, kindly, and successfully discharged by Miss Nightingale and her female followers, I most willingly acknowledge the civil element; and in so far as these benevolent ladies have made up for the want of numerous orderlies, and thus spared the effective force of regiments, I am sure that every commanding officer will feel grateful to them.

Touching the alleged failures in the Crimea, "the medical department failed," says a public writer, "not because Surgeon Brown could not dress a wound, or Dr. Jones prescribe for a case of dysentery, but because no adequate preparation had been made for the reception of sick and wounded; because medical stores were sent to one port, while invalids were sent to another; and because purveyors were left to squabble for authority with inspectors, while patients were dying." And pray, whose fault was this? I have the best authority for saying, that had the resources and transport of the medical department been at its own disposal, much of the misery of that army would have been obviated.

One gentleman, I regret to think, has been most severely handled by the public press, not for any want of professional talent, but for apathy and want of interest, with which he was charged by the gallant officer commanding the troops. How far Dr. Lawson's health may have been impaired, and his energies prostrated, by a protracted residence on the coast of Africa, for which (with a spirit most becoming in an army surgeon) he volunteered his services, I am unable to say. It is many years since I have seen him, but it is due to this gentleman, and to the memory of his excellent uncle, the late Staff-surgeon Badenach, to say, that when a pupil of this class, some twenty years ago, a more steady, correct, industrious, intelligent, and promising student never sat on these benches. Of this you may judge by the following extract from the *Edinburgh Medical and Surgical Journal* for 1835:—"On Monday, the 16th day of April, at the last meeting of the class of Military Surgery in the University of this city, in the presence of a considerable number of the professors of the medical faculty, and most of the medical officers of the Army, Navy, and East India Company's Service, resident here, the professor, after concluding the lecture, proceeded to announce the names of the gentlemen who had obtained prizes."

"By nearly the unanimous votes of the class, after a competition conducted in the presence of the Principal of the University, and numerous professional gentlemen, the individual selected as most distinguished by a knowledge of the subjects of military medicine and surgery, was Mr. Robert Lawson, from Perthshire, in which decision the professor concurred, and Mr. Lawson was accordingly recommended to the Director-General. We understand that he has since received the appointment so justly due to his merits."

It was, I think, upon that occasion that my predecessor Dr. Thomson, in congratulating me on the appearance of my pupils, observed, that Sir James M'Grigor would require to extend his patronage—enough to show that Dr. Lawson did not win his honours without a formidable competition.

There is only one other point, Gentlemen, on which I should wish to be indulged with a few words; but as I have already trespassed upon your time, and have elsewhere expressed myself on the subject, I will endeavour to be brief. I have been very sorry to find anything said which is calculated

to disparage our regimental hospitals, or any countenance given by gentlemen whose judgment I respect, to the opinion that they are only adapted to peaceable times, and that a forty years' peace has disqualified the medical officers of the army from expanding their views to the management of a general hospital.

This seems to me to be altogether a gratuitous assumption; and I would observe that it was not in a time of peace, but of war, that the advantages of our regimental hospitals became fully developed. Hear what the late venerable Director-General says upon this subject! In a letter to his friend the late Dr. Chisholm, written at the termination of the Peninsular war; after expressing his surprise at the extent and success of the regimental hospitals, Sir James M'Grigor goes on to say,—“However short a time a battalion or a corps rested in one place, a regimental hospital was established. It was frequently established in the face of an enemy; and nearly within reach of his guns. By making every corps constantly keep up an establishment for itself, we could prevent the general hospitals from being crowded. Much severe and acute disease was treated in its early and only curable stage, and no slight wounds or ailments were ever sent off from the regiments; by which means the effective force of the army was kept up, or perhaps increased by several thousand men, and this was effected by the joint exertions of the medical officers who served in the Peninsula, the result of medical science, and their experience of soldiers, their habits, and their aptitude to particular diseases.” Dr. Chisholm adds for himself—“In regimental hospitals, health and economy are united—in general hospitals, death and a destructive waste of money. My own experience, which has been tolerably extensive, justifies this.”

It were superfluous, and it were idle to make farther quotations upon this subject, because I believe that every experienced man conversant with these hospitals, who has committed his opinion to paper, has expressed himself to the same effect. But on an occasion like the present, when the state of our hospitals has been so frequently and so unfavourably contrasted with those of our allies the French, it may not be out of place to refer to the sentiments of Baron Larrey. I had the pleasure of conducting that distinguished surgeon over the establishments of this city, both civil and military, now nearly thirty years ago, and I shall not soon forget the admiration which he expressed with the state of the regimental hospital in Piershill Barracks, then occupied by the 7th Hussars, and under the charge of an assistant-surgeon, Dr. Moffit. Not satisfied with this, he repeated his commendations to Sir James M'Grigor when he went to London, and wrote back to me to say that he had done so, and that he had commended to him the gentleman whom he was pleased to term my protégé. Dr. Moffit's promotion took place soon after, and he considered it hastened by this kind recommendation of the Baron.

General hospitals, however, are indispensable on every extended scale of warfare, and I believe they never can be more advantageously conducted

than by assimilating them as far as possible to our regimental establishments. General the hospital may be, general, as much as you will, in so far as the provisions, the cooking, the washing, the bedding, and the clothing of the sick are concerned, but let us, if possible, have their own surgeons to attend their own men. This may be carried to a great extent by classing the patients according to the divisions, brigades, or regiments to which they belong, having the medical staff of those divisions, brigades, or regiments to attend them, assisted by those non-commissioned officers and good conduct men of every regiment who may happen to be patients in the hospital, and who take an interest in their comrades, which strangers cannot be expected to do. This is a classification, as regards military hospitals, of equal, if not greater importance than some of those usually adopted on purely professional grounds; and the general hospital, whether under one or more roofs, thus becomes, as it were, a congeries of regimental hospitals.

I have already pointed out the difference between the province of the purveyor and the surgeon; and it is remarkable, that it is precisely at the point where the general and regimental hospitals meet, that the duties of a purveyor become paramount and indispensable, while the duties of a medical officer are in no degree changed, except in so far as he has to treat a disease which, having been acute in a regimental hospital, may probably have become chronic in a general one—a change for which surely every medical man is prepared. The purveying of a regimental hospital is for the most part a simple affair, and conducted successfully by the hospital sergeant, under the direction of the surgeon; but when serving in a general hospital, within the reach of daily or hourly communication with a purveyor, the surgeon is happily relieved of this.

So much are my old-fashioned notions in favour of the regimental principle, that I cannot help thinking it might with great advantage have been extended farther in the recent operations in the Crimea. Had the large addition, so strenuously recommended by Mr. Guthrie, been made to the regimental, instead of the general medical staff, I see nothing to have prevented the assistant-surgeons of regiments from having been detached in succession with the sick and wounded, just as the numbers of these increased, and as the number of fighting men diminished; to have succoured and assisted those men on their stormy passage across the Euxine, to have afterwards attended them in the hospitals on the Bosphorus, and to have returned to their regiments with such of them as might again have become fit to take the field. I am here only referring to what has repeatedly happened to myself. I have, over and over again, been detached from my regiment with parties of sick, and it has happened to me to have served, more than once, in general and garrison hospitals, and to have sometimes had a portion of one of them given up to me for a regimental establishment, according to an arrangement which may, I believe, at this moment, be seen in the King's Infirmary, in the Phoenix Park, at Dublin

or at least was to be seen when I last visited that establishment some few years ago.

I know of no duty of a staff assistant-surgeon to which a regimental assistant is not competent, but I do not hold that the converse of this proposition is equally true. I have the highest opinion of that "esprit de corps," which is fostered by regimental intercourse, and those "ties of regimental discipline," which, as Dr. Millingen says, "constitute the superiority of battalion hospitals." I know well how much that knowledge of character acquired by a regimental surgeon—that interest on the one hand, and that confidence on the other—engendered between him and his patients, contributes to the successful treatment of disease. I have, myself, been sent for to amputate the limb of a soldier, lying in a garrison hospital, a few miles distant from the spot where I happened to be encamped. This young man, finding that his limb must come off, asked as a special favour that his own surgeon might be asked to operate. This the garrison surgeon kindly consented to, and the young man speedily recovered.

The successful discharge of regimental duties was always looked upon in my day, and, I believe, very justly looked upon, as the best preparation for the duties of the staff, whether military or medical. Where, I should be glad to know, except in the exercise of regimental duties, were such men as Jackson, McGrigor, Hennen, Guthrie, French, Franklin, and many others prepared for those general duties which they have so successfully discharged in all quarters of the world? Of the last two named gentlemen, the former went to China as surgeon of the 49th regiment, and was placed at the head of the department as the senior medical officer of the Queen's troops employed in the Chinese War. The other was Inspector of Hospitals to the Queen's troops at Chillianwallah and Goojerat, those conflicts in the Punjaub which have given peace to that part of India for many years past. No! Gentlemen, I will not believe that the surgeons of the army are unequal to the conduct of general hospitals.

At the commencement of my last course of lectures, I promised myself numerous interesting communications from my friends serving in the war against Russia, and in this I have not been disappointed. I have lately had a letter from Dr. Hall, the chief of the medical staff in the Crimea—a man who has had both hard work and hard words—a man of much labour and little thanks. It is most gratifying to find him speaking confidently of the improved health and never-failing spirits of the men. From Dr. Deas, the head of the medical department of the Black Sea Fleet, and formerly a pupil of this class, I had lately a most valuable communication. He has conducted the duties of his department with much credit to himself, and with great advantage to the public service, notwithstanding the scarcity of hands in the junior ranks of the naval medical establishment. It would appear that he early detected, as an observant naval officer might be expected to do, the extensive prevalence of a scorbutic taint amongst all

hands, soldiers, seamen, and marines, which rendered, in many instances, their dysenteries intractable, and their wounds incurable. From Dr. Linton, who was a frequent attendant in this class-room some two years ago, I had some touching details of poor Dr. Mackenzie's last hours, and of the earlier operations in the siege of Sebastopol. He was, and still is, at the head of the staff of the First Division, at one time so gallantly commanded by the Duke of Cambridge, who, I observe, has expressed himself fully satisfied with his medical officers.

Amongst other recent communications, I have had a very kind letter from Sir James M'Grigor, thanking me for a letter which I addressed some months ago to the Secretary-at-War, on the Medical Department. He evidently feels and deeply deplores what he calls the "black cloud" which has fallen on the department; expresses a confident expectation that it will right itself; and concludes with a well-known Scotch proverb—"We maun jouk and let the jaw gae o'er."

It is with pleasure that I refer, for one moment, to another matter in which some of you are aware that I have taken great interest—the endowment of chairs of military surgery in the two other capital cities of the empire. From a reply by Mr. Peel, the Under Secretary-at-War, to a question put to him in the House of Commons by Mr. Grogan, the member for Dublin, it would appear that arrangements are making to carry out this measure. In Dublin, a class of military surgery has for several years been in operation, and I trust that the gentleman who has so well conducted it will speedily be commissioned by the Crown, and put in possession of an endowment. In as far as concerns London, I believe that one great difficulty has been the trouble and expense of removing the Chatham Museum to town, but this I have always looked upon as something very like a bugbear; nor have I ever been able to see why it should be the cause of one hour's delay. If the mountain cannot be brought to Mahomet, why should not Mahomet go to the mountain? How often did my late venerable colleague, Professor Jameson, cross the Forth with his pupils to illustrate his geological views by showing them the rocks on the coast of Fife? How often, and how far, does my excellent colleague, and former pupil, Dr. Balfour, go into the country to illustrate his botanical doctrines? He thinks nothing of going with his pupils to Aberdeen before breakfast, botanising for the day, and returning in the evening. As some indication that the Government has now come to see the propriety of encouraging special courses of instruction for the rising generation of military and naval surgeons, I may mention that I have lately obtained, through the assistance of our city member Mr. Cowan, who kindly visited my museum that he might be able to speak to the point, a small grant of money for the purpose of putting that museum into better order, and reprinting my Catalogue, which I hope to be able to put into your hands before the close of the session.

Current Literature.

Plague Data from South Africa. Infection by Gerbilles and Veldt Rodents. Copy of memorandum by Dr. A. Mitchell (*Bulletin of the Office International d'Hygiène Publique*). *Plague Prevalence in the Union of South Africa*.—The position of the Union of South Africa in regard to plague and the work which has been done to clear up that position are stated fairly fully in the Health Reports issued by the Union Department of Public Health for the calendar year 1920, for the eighteen months ended June 30, 1922, and for the year ended June 30, 1923.

Further information on the subject will be found in a paper by Dr. Mitchell read at the South African Medical Congress at Cape Town on October 9, 1921, and published in the *Journal of Hygiene*, vol. xx, No. 4, of January 17, 1922, and in another by Dr. L. G. Haydon, Senior Assistant Health Officer in the department, published in the *Proceedings of the Royal Society of Medicine* (Epidemiological Section) October 28, 1921, and reprinted in the *Lancet* of November 26, 1921.

The history and present position of the matter briefly is that the infection of plague was introduced to a number of the ports of the union—Cape Town, Port Elizabeth, Mossel Bay, Knysna, East London and Durban, by infected rats on vessels carrying forage, etc., from Rosario and other South American ports during the Anglo-Boer War, 1901-02: epidemics of the disease in man and epizootics in animals resulted at these ports; subsequently various small outbreaks, both in man and rodents, occurred at inland centres, notably King William's Town, Queenstown, Pietermaritzburg and Johannesburg; active measures were taken to limit and eradicate the infection, and by the end of 1905 it was at the time thought that these efforts had been successful; except for a small outbreak of thirty-two cases with twenty-six deaths in Durban in 1912—due to a fresh importation of infection from overseas—no human cases of plague are known to have occurred in the Union during the years 1904 to 1913 inclusive; in 1914 a virulent outbreak occurred in one of the inland districts of the Cape Province and spread to neighbouring districts; this prevalence continued into 1915, and in 1916 sporadic cases of the disease began to crop up in the north-western districts of the Orange Free State, and in these districts sporadic cases and occasionally small outbreaks have occurred from time to time since. The total cases from 1914 to 1920, inclusive, was 203, and the deaths 138.

During the prevalence at the ports of the Union in 1901 and 1902 evidence of mortality amongst the wild field rodents had been found on the outskirts of the town, notably in the case of Knysna, Mossel Bay, East London and Port Elizabeth. In 1920, as a result of study of the various

outbreaks which had occurred, the view was formed that infection was being disseminated and perpetuated by the field rodents and other small wild animals, a view which was conclusively proved to be correct in February, 1921 (see Annual Reports).

During the eighteen months ended June 30, 1922, a total of 24 groups of cases occurred, numbering in all 42 cases with 23 deaths, all of the cases occurring in the north-western part of the Free State.

Only two cases occurred during the year ended June 30, 1923, these being in natives on a farm in the Molteno district in the northern part of the Cape Province. Evidence of infection in wild rodents was found in the neighbourhood. From this focus a rodent survey was made of the whole central area of the Union, and it was found that plague infection existed, or had recently existed, amongst wild rodents in a considerable part of this area. (For details as to the results of the survey and the methods followed see Annual Report.)

In October last a small outbreak, comprising seven cases, all of them fatal, occurred in a remote bush veld area of the Uitenhage district, Cape Province. Investigation showed that plague infection existed amongst the veld rodents, especially the striped mice, in the locality.

A prevalence in the north-western area of the Orange Free State (the area in which sporadic cases have been cropping up since 1916) commenced in December last.

The total cases and deaths from December 8, 1923, to March 22, 1924, have been as follows:—

			White		Native		Total
Cases	...	...	28	...	170	...	198
Deaths	...	...	10	...	99	...	109

One hundred and eighty-seven of these cases occurred in the north-western part of the Orange Free State within a radius of about thirty-five miles, the remaining eleven occurred in the northern part of the Cape Province, south of the Orange River, within a radius of about twenty-five miles. All the cases have been on scattered farms or small aggregations of native dwellings. In the great majority there has been definite evidence of mortality from plague amongst the rodents in the locality; there have been comparatively few instances of human case to case infection. The cases have been mostly of the bubonic type; there have been nine cases of pneumonic type occurring in thickly placed groups of native huts on two farms.

A map (not reproduced) shows the position as regards plague infection amongst veld rodents in the Union as far as is known at the present date. The yellow areas on the map comprise sand veld areas which ordinarily have an abundant population of wild rodents, and these are known to be plague infected, or to have been plague infected within the last few years. The blue areas are country similar to the yellow and with a considerable population of gerbilles and associated veld rodents, but so far as is known

these are at present free from plague. The red areas comprise clayey, gravelly, or rocky country or bush veld largely free from gerbilles and associated wild rodents, but having in many places considerable numbers of striped mice, karroo rats and other rodents. No plague infection has occurred in these areas, with the exception of the small outbreak in the Uitenhage district in October last already mentioned.

The parts of the Union shown uncoloured on the map have not yet been surveyed, but at present, so far as is known, they are free from plague either in man or rodents. It may be mentioned that very careful supervision is exercised at the ports with a view to the prompt detection of plague, and that no evidence of such infection has been found, either in man or in rodents, at any port of the Union since 1912.

The recent prevalence of plague is mainly an episode in connexion with the existence of widespread enzootic infection amongst veld rodents. Ordinarily the infection quietly smoulders amongst these animals, but sometimes—usually in the warm season when all forms of insect life, and especially fleas, are abundant—it is apt to flare up and spread widely and rapidly amongst the rodent population, and concurrently cause cases of the disease in man.

The main agent in perpetuating and spreading the infection is the gerbille (*Taterona lobengula*), a rodent which is about the size of a small grey rat, is strictly nocturnal in its habits, very prolific, lives in colonies, digs deep burrows and intercommunicating runs in the ground, feeds mainly on small bulbs and roots, and is extremely difficult either to trap or poison. It avoids human dwellings, but has the peculiar habit of nightly visiting the burrows of its species over a considerable area, so favouring the spread of infection. The main intermediate or carrier of the infection from gerbille to man is the multimammate mouse (*Ratus coucha*) which freely uses the burrows of gerbilles and other veld rodents but also frequents human habitations, especially native huts. In the rural areas it largely takes the place of the common house mouse. Other wild rodents of the veld which are known to acquire the infection and which play a part in the perpetuation and spread of plague, are the striped mouse (*Arvicanthus pumilio*), the ground squirrel (*Xerus capensis*), the water rat (*Otomys irroratus*), mole rat (*Cryptomys*), and the Eastern Karroo rat (*Barotomys luteolus*).

The measures in operation for controlling and dealing with the outbreak, and for preventing the spread of infection, are briefly as follows:—

Prompt notification of all deaths and of the occurrence of any case of suspicious illness; rat-proofing of stores, shops, dwellings, etc.; protection from rodents of grain and other foodstuffs likely to attract or be eaten by rats; disinfection of infected premises and articles; prohibition of removal or handling of plague-infected articles pending disinfection; isolation of cases; isolation or medical surveillance of "contacts" and the deverminization of their clothing and effects; prohibition of movement of natives

from infected areas except after medical examination and certification to be clean and free from infection ; prohibition of removal of grain from the area except after being passed through "elevators" in which the grain is carefully screened and winnowed ; disinfection of stacks of grain with carbon bisulphide, hydrocyanic gas and other agents.

The greatest risk has been the extension of the infection to the "domestic" rodent population of some of the towns in the neighbourhood of infected rural areas, but up to the present no such extension has occurred. Urban local authorities throughout the Union have been taking active measures against rats, and recently drastic regulations requiring the rat-proofing of shops and stores and empowering local authorities to issue orders in respect of the rat-proofing of dwellings and other buildings have been promulgated to be in force throughout the Union.

The really difficult problem in connection with this matter is the effectual limitation, and eventually the eradication of the infection among the wild rodents. The experience gained in South Africa shows that plague in man can easily be controlled and eradicated, but the control and eradication of the infection in rodents, and especially in wild rodents, is a matter of much greater difficulty. In many parts of the infected area, and especially in the north-western Free State, veld rodents are extremely numerous, due to the development of farming and concurrently the destruction of jackals, wild cats, owls, snakes and other natural enemies of rodents, thus interfering with the balance of nature.

The sanitary authorities are at present carrying out tests and experiments with methods of destroying veld rodents by gassing with carbon bisulphide, hydrocyanic gas and other lethal agents ; also with dynamite and other explosives. A thorough investigation is also being made of the methods of poisoning and the discovery of effective baits for the different species of veld rodents. Steps are being taken to organize systematic research along bacteriological and entomological lines and to explore thoroughly the possibilities of artificial infection such as Danysz' virus.

The Prevention of Dental Caries and Oral Sepsis. By H. P. Pickerill (Abstract).—The commonly accepted explanation of the pathology of dental caries, as advanced by Miller in 1885, is adopted by the author, who summarizes it as follows :—

(1) That the organisms of the mouth, by secretion of an enzyme, or by their own metabolism, so act upon carbohydrate food material as to form acids by a process of fermentation. The chief acid formed is lactic, but butyric, acetic, formic, succinic and other acids may also be formed.

(2) Carbohydrate food material lodging between or on the teeth is the source of acid, which attacks the lime salts of the enamel, dissolving the interprismatic cement substance. Thus by the action of the acid and by the force of mastication the enamel is destroyed or weakened, and removed mechanically.

(3) The action of the micro-organisms of the mouth upon protein material is to form an excess of alkaline substances that have no action upon the enamel other than a beneficial one.

(4) The enamel being penetrated, the solution of the lime salts of the dentine is brought about in the same manner, the organisms penetrating along the dentinal tubules.

(5) The further stages of caries of dentine is brought about by another set of organisms which secrete a proteolytic enzyme. This dissolves the collagen of the dental matrix, thus forming a cavity.

The book is largely devoted to a consideration of the natural defences against caries and the manner in which they break down among modern civilized communities. The defences are described as (i) Passive, the enamel surface of the teeth, and (ii) Active, the oral secretions.

The density and hardness of the enamel varies, at one extreme being the very hard dense enamel found on the so called "native" teeth of primitive races with a high degree of immunity to caries, and at the other, the soft and easily penetrated enamel of "malacotic" teeth which are the commonest type found among civilized races with a high incidence of dental caries. Apart from heredity the factors which tend to produce teeth of a resistant type are (i) the use of the jaws during early life in a manner that will expand and not constrict the arches and (ii) the presence in the saliva of an adequate supply of calcium phosphates in a dialysable condition for hardening the enamel. As regards (i) it is pointed out that among civilized races, particularly as compared with primitive races, the teeth are used almost entirely for grinding, the functions of crushing and incision having fallen largely into disuse owing to the prevalence of soft food and the use of knives and forks. It is argued that grinding tends to constrict the jaws while incision and crushing expand them. The adequate supply of calcium phosphate in a dialysable condition is considered along with the features of the saliva which provide active protection against caries.

Although the condition of the enamel is of undoubted importance in the ætiology of dental caries, Professor Pickerill considers that much the most important, as well as the most easily controlled factor, is the quantity and constitution of the saliva. He considers that the functions of this secretion in connexion with preventing dental caries are: (1) Mechanical removal of debris; (2) neutralization of the acids of the foods and those formed by fermentation; (3) the digestion of carbohydrate debris so as to facilitate their removal; and (4) the supplying of phosphate of calcium for hardening the enamel. The efficacy of the saliva in those functions will depend largely on its quantity and the amount of alkali, ptyaline and calcium phosphate, which it brings into contact with the teeth.

Previous investigations on the saliva are criticized on the grounds that many of them were made on animals and that the stimuli employed were not natural ones. Chemical substances were employed in far greater strength than they occur in foods, and the electrical stimuli are open to the

objection that the selective action of the reflex stimuli is lost. Experiments on the human subject are described where the stimulus employed was the mastication of various common articles of food, the whole of the saliva from one side of the mouth being collected. These experiments demonstrated the following points :—

(1) It is evident that the saliva is a fluid extremely variable in its composition and amount, that these variations do not occur without reason, but rather in obedience to fixed and definite laws and in response to certain ascertainable stimuli.

(2) The mechanism controlling salivary secretion is extremely sensitive and complex, since different "flavours" of little intensity are capable of being "selected," and give rise to secretions of saliva differing widely in character and amount.

(3) That practically all the normal constituents of saliva are, if present in sufficient amount, of value and importance in protecting the teeth against the occurrence of dental caries, and in maintaining the health of the oral mucous membrane.

(4) That acids, and particularly the natural organic acids, are the stimulants which excite the greatest amount of these protective substances per minute, and moreover give rise immediately and for a considerable time afterwards to an increased alkalinity of the mouth. That, conversely, substances of little or no distinctive flavour, and also alkalies, produce a diminution in the amount of protective substances per minute, and reduce the alkalinity of the mouth both at once and for some time afterwards.

(5) That in the saliva is provided a natural and potentially perfect mouth-wash acting continuously day and night (not merely for a few minutes a day). That it is, moreover, completely under control; that it may be altered or varied in amount or composition; that its beneficial effects may be increased or decreased absolutely at will.

The practical application of these experiments and the conclusions drawn from them are summarized as follows :—

(1) That as to their fermentability and lodgeability—the "acid potential"—all carbohydrate articles of diet fall into two well-defined groups: (a) Those of originally neutral or alkaline reaction, giving rise to the formation of much acid; (b) Those of originally acid reaction, giving rise to very little or no acid, or a definite alkaline reaction.

(2) That by a mixture of strong salivary stimulants with the acid-forming carbohydrates the resulting reaction may be turned from an acid to an alkaline one.

(3) That this latter effect may be more certainly obtained by a sequence than by a mixture.

(4) That a mixture of protein (as meat) with carbohydrate has practically no effect in reducing the amount of acid formed, but that a sequence of meat after carbohydrate does prevent the formation of acid probably by its detergent action. Such a sequence is, however, quite impracticable and undesirable, and therefore has not been considered.

That in order to prevent the retention of fermentable carbohydrates on and between the teeth, and so eliminate, or very considerably reduce, the carbohydrate factor in the production of caries, starches and sugars should on no account ever be eaten alone, but should in all cases either be combined with a substance having a distinctly acid taste, or they should be followed by such substances as have been shown to have an "alkaline potential"; and the best of these are, undoubtedly, the natural organic acids found in fruit and vegetables.

The same considerations apply to dentifrices as to foods, and the prevalent use of alkaline dentifrices is strongly condemned owing to their action as salivary depressants. The author advocates the use of acid potassium tartrate for cleaning the teeth, as this results in a prolonged and copious flow of strongly alkaline saliva.

In support of his thesis the author reviews the dietaries of a number of primitive races and compares them with the dietary of American school children. He claims that his findings bear out his contentions as to the part played by diet in the etiology of dental caries. A comparison of the saliva of immune Maori children with that of susceptible European children showed a very marked increase among the former of the substances which are considered protective. There was no appreciable difference between the bacterial flora in the mouths of the two series.

The question of how the ordinary diet of the present day can be modified so as to conform to the requirements laid down is gone into in some detail. Drastic or revolutionary changes are considered both impracticable and uncalled for. "What is therefore to be advocated is that all meals should contain a fair proportion of salivary excitants, and, more important still, should both commence and end with some article of diet having an acid reaction."

Reviews.

THE MEDICAL DEPARTMENT OF THE UNITED STATES ARMY IN THE WORLD WAR. Vol. I. The Surgeon-General's Office.

The history of the "Medical Department of the United States in the World War," will comprise fifteen volumes, some of which will be printed in parts. The first volume is entitled "The Surgeon-General's Office," and contains 1,336 pages, each ten inches by seven inches; of these 584 pages are devoted to the preface, general introduction and a description of the various divisions of the office and their relation to other departments, the remaining pages contain an "In Memoriam" appendix and the various War Department and Medical Department promulgations.

The volume commences with a letter of Transmission by Major-General M. W. Ireland, in which he states that when the war began there were 491 medical officers in the Regular Army, 342 in the Medical Reserve Corps

and 1,267 in the National Guard; the officers of the Regular Army and about fifty per cent of the National Guard were well trained, but most of the Medical Reserve were without any military experience. Some 335 commissioned dental officers were also available. There were 6,619 enlisted men and 403 women nurses in the Regular Establishment, and 8,014 nurses in the Reserve of the Red Cross. At the time of the Armistice there were 30,591 physicians "in service," 2,929 officers in the Sanitary Corps, 21,480 nurses and 281,341 enlisted men in the Medical Department.

In the preface Colonel Lynch acknowledges that the idea of preparing an official medical and surgical history of war originated in the Crimean War at the instance of the then Director-General, Andrew Smith. Since the time of the earlier records a revolution has been affected, even the history of the War of the Rebellion, an inexhaustible mine of information regarding diseases and injuries, is now regarded as out of date in relation to the practice of modern medicine and surgery. At that time there was no bacteriology, there were no laboratories, and there was no sanitation as understood at the present day.

In Part I of the general introduction Colonel Lynch traces the evolution of the Medical Department from ancient history, through the dark ages to the renaissance. We are told that the first field hospitals and ambulances on a large scale were established by Queen Isabella of Spain in 1484. Then follows an interesting account of the medical arrangements of armies during the American Revolution, the Napoleonic Wars, the war with Mexico, the Crimean War and the Civil War.

At the outbreak of war between the States there was only regimental first aid at the front, and base hospitals were situated well to the rear; there was no efficient system for the evacuation of wounded from the fighting line to the base. Letterman suggested an organization which was tried by the Army of the Potomac at Antietam on September 17, 1862; it proved successful and was soon adopted by the other armies of the United States. Letterman provided an ambulance corps for each army corps and a field hospital for each division, and under this system the battlefield was cleared of wounded in twenty-four hours. A study of the medical organization in the South African and Russo-Japanese Wars led to the provision of two evacuation hospitals of 324 beds for each division of about 18,000 officers and men. An evacuation ambulance corps was also provided to bridge the gap between field hospitals and evacuation hospitals at railhead. By 1910 the evacuation system was complete in plan from battalion station at the front to base hospital in the rear. Following on the lamentable experiences in the Spanish-American War great advances were made in field sanitation, and in 1911 "typhoid immunization" became a routine procedure in the American Army. In the great armies in France and America there were, during 1918 and 1919, only 1,897 cases of typhoid fever with 227 deaths. During the mobilization on the Mexican border

in 1916, it was found that paratyphoid fever could be controlled by a vaccine, and as a result a triple vaccine was made available for the troops and its universal use was enforced. A triple vaccine was authorized for the British Army in 1915. Between the Spanish-American War and the entry of America into the World War there was a marked development of sanitary conscience in the troops and also in the civil population, which contributed greatly to the maintenance of health of the armies in France and America.

On April 14, 1916, a committee on medical preparedness was organized by a number of eminent surgeons, and on receiving sanction from the President the committee made a survey of the medical resources of the country, including hospital facilities, buildings available for hospitals, facilities for transportation of sick and wounded, food and drug supplies, and of trained nurses available, etc. On August 29th, 1916, a Council of National Defence was approved by Congress for the purpose of co-ordinating "industries and resources for the national security and welfare." The medical committee of this council "lined up" the medical profession, so that when war came a large body of medical men, classified according to medical qualifications, was immediately available for service. A committee on dentistry, a committee on the standardization of medical and surgical supplies and equipment, and a hospital committee were also formed. When the United States entered the War the work of these committees "proved the saving of months of time."

In Part II of the General Introduction, Brigadier-General T. R. Kean deals with the development of the Red Cross medical units. During the period that America occupied the position of a neutral many eminent medical men visited France and England; small groups from the U.S. Medical Schools served at the American ambulance at Neuilly, and other groups served with medical units in England; in this way first-hand knowledge of medical conditions in war was acquired. Dr. Crile suggested that base hospitals should be formed from the staffs of large civil hospitals, the surgeons would then know each other and the nursing staff would be familiar with their methods. The Surgeon-General authorized Dr. Crile, Dr. Harvey Cushing and Dr. Swan to proceed to organize base hospitals. In 1915, however, the National Red Cross had been divided into two great departments of civil and military relief, and Colonel Kean selected to organize the military relief which, according to the Red Cross charter, should include the provision of military units from civil life. The Red Cross approached the Surgeon-General on the subject of the base hospitals and it was finally decided that the Red Cross should organize the hospitals, but on a strictly military basis, the personnel being commissioned and enlisted men of the reserve corps, so that when called into active service the authority of the Red Cross would cease completely. Only the larger civil institutions could furnish the twenty-three medical officers needed for a base hospital of 500 beds. Units of 250 beds with a staff of twelve

medical officers were furnished by the smaller institutions and proved very valuable in France for the establishment of camp hospitals, and for the rapid enlargement of base hospitals. Forty-five ambulance companies were organized by the Red Cross, and most of them were assigned to divisions. On April 27 six base hospitals and 116 other medical officers were selected for service with the British Medical Service. In July, 1917, it was decided to increase the base hospitals from 500 to 1,000 beds. The Red Cross base hospitals and hospital units formed the backbone of the hospital service in France; on July 18, 1918, there were twenty-six divisions in France, and for these there were eight evacuation hospitals and forty-two base hospitals, of which thirty-six had been organized by the Red Cross.

The relationship of the medical department within the military establishment is described in Section 1. Three plates are given, showing in diagrammatic form (1) the relationships of the medical department prior to the world war, (2) relationships of the medical department, period of the world war, (3) relationships of the medical department, source and distribution of personnel, materials and supplies—functions, during periods of the world war. The duties of the medical department seem to be much the same as those of the medical department of the British service, except that the American Medical Department is "charged with protecting the health and preserving the efficiency of the animals of the Army," and for this purpose a large number of veterinary surgeons are included in the personnel.

Section II is devoted to the organization and administration of the Surgeon-General's office. The Surgeon-General, ranking as a Major-General, is the head of a bureau of the War Department; he is the adviser of the Secretary of War and the chief of the staff upon matters relating to the health, sanitation, and physical fitness of the army and the administration of the medical service in all its branches. Major-General W. C. Gorgas served as Surgeon-General from April 6, 1914, to October 4, 1918; he was succeeded by Major-General M. W. Ireland on October 30, 1918. Diagrammatic plans of the first, second and third floors of the Surgeon-General's office are shown in Plates VI, VII, and VIII, and Chart I illustrates the organization within the office by "units of activity" and the relationship of "co-operating activities" in June, 1918. There were thirty-one divisions in the office administered by the assistants to the Surgeon-General, Brigadier-General Birmingham and Brigadier-General Richard. Gas defence was one of the divisions, but in July, 1918, it was transferred to the Chemical Warfare Service.

Limitation of space will not permit us to give even a general idea of all of these divisions, each of which had a very complete organization, shown diagrammatically in a chart. We can only deal with a few points of general interest.

Plate IX shows the strength of the medical department by months from April, 1917, to June, 1919. In November, 1918, there were 30,591 medical

officers, 21,480 nurses, 4,620 dental officers, 2,919 sanitary officers, and 2,234 veterinary officers ; 29,299 officers were commissioned directly from civil life. Examining boards were appointed in all the principal cities and posts in the United States, and the examination was both physical and professional.

The Surgeon-General's office estimated that in time of war ten medical officers would be required for each 1,000 of the total strength of the army. Experience showed this estimate to be substantially correct for an army of 2,000,000, but for a larger army the proportion might be slightly reduced. Enlisted medical personnel was allowed to the extent of ten per cent of the enlisted strength of the army, and at the Armistice 281,341 men were in active service ; of this number 17,160 were in the Veterinary Corps, 7,605 in the Ambulance Corps and 3,945 in the Sanitary Corps. In the Nursing Corps for the first time in the history of the Army women "graduate dietitians" were employed in the army hospitals at home and abroad ; they were responsible for the preparation of menus and for proper cooking and service of food.

In April, 1917, there were only eighty-six dental officers in the United States army, a Reserve Corps was formed in which dentists were commissioned after examination and very soon there were sufficient dentists, actual or prospective, for an army of 5,000,000 men. In September, 1918, two dentists per 1,000 men were approved and assigned to camps.

In the Division of Sanitation there were sections for hospitalization, medical officers training camps, laboratory and infectious diseases and field sanitation ; later on these were placed in separate divisions. A sanitary inspection service was established in July, 1917, and camp sanitary inspectors were advised to "establish relations" with the local representatives of the Public Health Service. In the section on communicable diseases epidemiologists were appointed and one was assigned to each camp ; detention and quarantine camps consisting of huts holding eight men, or tents holding five men, were constructed in each cantonment. In cases of diphtheria all close contacts shown to be non-immune by the Schick test were to be immunized by antitoxin. The Sanitary Corps was organized in June, 1917, its officers were not graduates in medicine : sanitary engineers were represented in the Corps and were responsible for water supplies, sewerage, mosquito-control operations, and control of fly breeding, disposal of garbage and manure, housing and ventilation. For many years prior to the world war the Division of Sanitation was responsible for physical standards and for the physical examination of officers and enlisted men. In 1917 the pre-war physical standards were revised. In the War Department Promulgations, general rules for the examination are given and also tables of accepted measurements and variations from the standards which may be accepted when the applicant is "evidently vigorous and healthy." Instructions for the preparation of identification records include the taking of finger prints. Special regulations are given for the physical examination for flying.

In May, 1918, development battalions were formed in divisional camps with the object of developing unfit men for duty with combatant or non-combatant forces and to rid the Service promptly of all men who when treated are found physically, mentally, or morally incapable of performing the duties of a soldier.

In June, 1917, there was formed a division of infectious diseases and laboratories containing three sections: laboratories, dermatology, and urology and combating venereal diseases. Later, epidemiology was transferred to this division and dermatology and urology were transferred to the division of surgery. The division of sanitation was regarded as the executive division for the prevention of disease, and this new division was to concern itself with the study of disease, on which recommendations for prevention would be made. Intestinal diseases and sputum-borne infections were regarded as the most important. Considerable advances were made in the study of the latter group: a hæmolytic streptococcus was found to play a prominent rôle in the pulmonary infections. An experiment on prophylaxis was made with a pneumococcus vaccine containing Types I, II and III. The results were favourable. A good deal of work was done on cerebrospinal meningitis; a very high percentage of carriers was found in Camp Jackson by a special technique; a large percentage of these carriers was, however, found to be harmless. A double serum was made for the treatment of gas gangrene and large quantities were shipped to France.

In October, 1917, a division of food and nutrition was formed under a distinguished physiologist. The division was to safeguard the "nutritional interests" of the Army by (1) careful inspection of the nutritional value of the food; (2) improving the cooking and serving of food; and (3) by constantly studying the suitability of the ration as a working-man's diet. Nutritional surveys of camps were made both at home and abroad. A nutrition officer was posted to each camp of 10,000 men or more.

Before the United States entered the world war there was no hospital section in the Surgeon-General's office. A division was organized in 1917. Hospital plans for thirty-two large camps had to be prepared. Hospitals for mobilization camps were planned on a basis of $3\frac{1}{2}$ per cent of the troops; this proved inadequate and was raised to $4\frac{1}{2}$ per cent. Most of the hospitals were obtained by remodelling hotels, sanatoria and other large buildings. On Armistice Day there were in the United States ninety-two large hospitals providing 120,916 beds. There was a special division for the provision of hospitals overseas; hospital beds sufficient for fifteen per cent of the troops serving abroad were established.

In the division of general medicine a tuberculosis section was formed and it was decided to re-examine the army of the United States for tuberculosis. By January, 1919, 3,288,669 men had been examined and 22,596 were rejected for tuberculosis.

The field of surgery was divided into a division of general surgery, a division of military orthopædic surgery, and a division of surgery of the head,

which had sections for ophthalmology, otolaryngology, brain surgery, oral and plastic surgery. The greatest care was taken in the selection of surgeons for duty with the divisions and sections. The preparations for the care of cases of injury of the face and jaws were based on the experiences of the Allies and close co-operation between surgeons and dentists was secured.

The volume under notice shows the meticulous care with which the Surgeon-General's office was organized; it cannot fail to be of great service to all officers of the American Medical Corps and will be invaluable should the United States again become involved in a war of the magnitude of the Great War.

EAR, NOSE AND THROAT TREATMENT IN GENERAL PRACTICE. By G. Portmann. London: W. Heinemann. 1924. Pp. viii + 180. Price 10s. 6d.

The part of this work which chiefly appeals, because it fills a lamentable gap in many other volumes, is the first chapter on "Technique in Treatment." Too many authors seem to take it for granted that such technique has been acquired by the reader when a student, a presumption which is unfortunately too often untrue. The inference is that all authors must have been exceptional students with exceptional opportunities. To cite a common example as part of the treatment recommended for syphilis in the young, one often finds the bland statement "Mercurial Inunction" with no details as to how this should be done to ensure best results. I fail to see how the addition of details regarding really important items of treatment can do other than enhance the purpose with which a book is written, and this addition need not enlarge a volume out of all proportions.

It is necessary to say a word regarding the method advocated of washing out the maxillary antrum as a means of diagnosis or treatment, which is that in common use by most specialists in this country possibly through ignorance that a better method exists.

The method advocated by the writer is that recommended and practised for many years by Mr. Waggett of piercing the inner antral wall above the inferior turbinate, i.e., in the middle meatus, with a Killian puncture needle instead of the common practice of puncturing below the inferior turbinate in the inferior meatus, using a Litchwitz trocar and cannula. The advantages of the former method are as follows:—

- (1) It is easier of performance and less dangerous in inexperienced hands.
- (2) If properly performed it is painless.
- (3) The use of this type of needles ensures a thorough washing out of all the antral recesses which is not always possible by means of a fixed cannula of the Litchwitz type.

The only *adverse* criticism that can be offered is against advising the free use of cocaine, a practice quite at variance with English custom and especially to be deprecated in the case of young infants and in

acute conditions. In many cases where its use is recommended it is frequently totally unnecessary as well as being highly dangerous. There are certain conditions such as acute sinusitis where the application of a pledget of wool soaked in *adrenalin* and cocaine near the osteum is an essential part of the treatment, and where no substitute is anything like as efficient. Cocaine, exhibited always in conjunction with *adrenalin*, is a very valuable drug and used with discretion is better than any other substitute so far tried.

With the above reservations this volume can be thoroughly recommended both for the use of specialists and general practitioners. The wealth of prescriptions offers the latter a whole therapeutic gamut, out of which he can make a choice and modify, vary or graduate his treatment.

J. H.

ORGANIC SUBSTANCES, SERA AND VACCINES IN PHYSIOLOGICAL THERAPEUTICS. By W. Carmalt Jones. London: Heinemann. 1924. Pp. viii + 393. Price 15s.

The writer aims at furnishing the general practitioner with the information necessary for the employment of organic extracts, sera and vaccines as far as possible scientifically and empirically in accordance with the experience which has been collected up to date.

With this object, each section of the book opens with a brief account of the underlying physiological facts and theories, followed by a consideration of the practical application of these principles in general and for each substance in detail.

The first ninety pages are devoted to organotherapy and include detailed accounts of thyroid, adrenal and pituitary extracts and insulin, together with notes on the less important glandular substances.

The remainder of the book deals with vaccine and serum therapy and prophylaxis. General principles of immunity are dealt with in the light of modern research and are applied to questions of therapeutics and serological diagnosis. The importance of accurate diagnosis is emphasized by the inclusion of a chapter in which bacteriological, serological and cutaneous sensitivity methods are explained in sufficient detail to enable the non-specialist to form an estimate of their value and to co-operate effectively with the laboratory. The uses of vaccines and sera are described in considerable detail, a whole chapter being devoted to tuberculin.

As might be expected in a work of this nature the author quotes extensively from leading authorities and official reports, but he welds the whole into a logical and coherent treatise by his own observations based on experience at St. Mary's and the Westminster hospitals and in general clinical practice. The book is thus very readable and at the same time convincing and unprejudiced. Though it does not pretend to be a laboratory handbook, in many cases the descriptions of technique are very full. They may be skipped by those not sufficiently interested.

The author is to be congratulated on the arrangement of the matter which makes the book interesting to read as a whole and handy for reference. We think most medical men would find it of considerable assistance.

A DESCRIPTIVE ATLAS OF RADIOGRAPHS OF THE BONES AND JOINTS.

By A. P. Bertwistle, M.B., Ch.B., Leeds. Bristol: John Wright and Sons, Ltd. Crown 4to, 208 pp. Price 17s. 6d.

This atlas is the forerunner of at least three such atlases advertised, and it will be of interest to compare them together, when all are published.

The preparation of any such atlas needs great care and necessitates the experience of a large number of radiograms before suitable cases are selected for reproduction as "types" of any particular condition. The method of silhouette added is a real advantage.

The actual results in the reproduction of the numerous radiograms on the paper used are not entirely successful, as in bone radiography the necessity for good detail is paramount, and the detail is poor in many of the reproductions.

The atlas, however, is certainly useful as a demonstration of a variety of radiograms, but does not appear to reach the ambition of the title. The ideal atlas should contain radiograms with "key" diagrams, so that the student and the beginner in radiology will be helped in the first place with the normal shadow anatomy of the various bones and joints.

The inclusion of so many obvious "fracture-radiograms" seems unnecessary. The diseases of bones and joints, as projected on the sensitive film, merit full detailed descriptions to aid in their differential diagnosis.

The atlas is of considerable interest, as it is an advance in a new line, which is always welcome, and the author is to be congratulated on what must have been a heavy task; but for instruction in the interpretation of radiograms the actual negative itself will always have pride of place.

D. B. McG.

WHEELER'S HANDBOOK OF MEDICINE. By William R. Jack, B.Sc., M.D., F.R.F.P.S.G. Seventh Edition. Edinburgh: E. and S. Livingstone. 1924. Pp. v + 629. Price 12s. 6d.

This new edition of "Wheeler and Jack" has been re-written in parts and brought up to date by inclusion of notes on such matters as vitamins and treatment by insulin. Unfortunately the revision was not extended to include the section dealing with Metazoan parasites, which stands in urgent need of editing. Regarding parasitic worms the introductory paragraph makes the astounding statement, "The parasites belong to the order *Vermes*, and are divided into three genera, *Cestoda* (tapeworms), *Nematoda* (round worms) and *Trematoda* (flukes)"! From this the reader will surmise that the author has not made any close study of medical zoology.

an impression which is confirmed by the succeeding pages of the section.

This handbook has passed through two editions and one reprint within the past five years, a sufficient evidence that it fulfils the requirements of those students of medicine who prefer to have their one halfpennyworth of bread unencumbered by any intolerable deal of sack. W. P. M.

Correspondence.

CORRESPONDENCE SCHEME FOR THE INSTRUCTION OF R.A.M.C. OFFICERS.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

DEAR SIR,—I am in entire sympathy with the correspondence scheme outlined by Major M. B. H. Ritchie, D.S.O., in the Corps Journal.

Recent examination experience has proved to me the marked inequality of knowledge of Royal Army Medical Corps duties in the field which exists amongst officers of the Corps. Although the General Medical History of the War gives much valuable information, the increasing mechanicalization of modern armies is producing problems which affect the Corps quite as much as the fighting services. A private correspondence scheme among majors and captains avoids the restraint often felt during lectures, staff exercises, etc., in the presence of senior administrative officers, and should stimulate study.

Much knowledge might be gained by the Corps if officers could overcome their shyness, and the fear that the story of individual experiences is "advertising."

Few of us know much about work with cavalry and tanks, and yet experience in cavalry work exists.

The scope of such a correspondence scheme is great, and the originator will deserve well of his brother officers if he can surmount the difficulties and keep enthusiasm going.

*Headquarters,
Scottish Command,
Edinburgh,
September 29, 1924.*

I am, etc.,
R. S. HANNAY,
Colonel.

Notices.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc. He will also be glad to receive items of news and information regarding matters of interest to the Corps from the various garrisons, districts, and commands at home and abroad.

All such Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notified at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

A free issue of twenty-five reprints will be made to contributors of Original Communications and of twenty-five excerpts of Lectures, Travels, Clinical and other Notes, and Echoes of the Past.

Any demand for *reprints, additional to the above*, or for excerpts must be forwarded at the time of submission of the article for publication.

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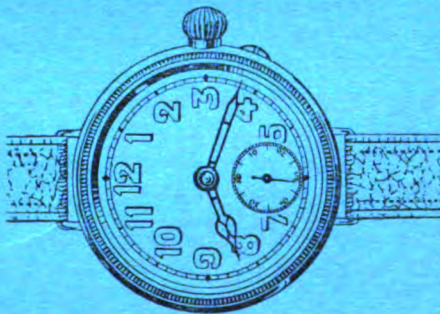
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Original Communications.

HEPATOSIS (OR TROPICAL ABSCESS OF LIVER): AN EXAMINATION INTO THE DIAGNOSIS AND TREATMENT OF THIS DISEASE IN INDIA, WITH ESPECIAL REFERENCE TO THE USE OF EMETINE.¹

BY MAJOR R. S. TOWNSEND, M.C., M.D.
Indian Medical Service.

It would seem, at first sight, that to write a thesis on such a well-known subject as liver abscess would be merely copying from textbooks on medicine and surgery, especially those devoted to tropical diseases.

I have been, however, greatly struck in reading recent editions of these works to find that many statements, true in the past, have descended from volume to volumé, and that writers have not realized the change in the course of the disease as seen to-day. In Europeans, the liver abscess which is diagnosed, either visually by a great swelling of the liver, or by evacuation through the lung, is seldom now seen. This, especially in the Army, is due to the universal use of emetine in the treatment of inflammatory diseases of the liver. The amœbic liver of to-day, following on dysentery treated by emetine, is often more difficult to diagnose in early stages, just as anti-typhoid inoculation often makes the early diagnosis of enteric a hard problem.

Unfortunately, despite the more effective treatment of dysentery, the mortality rate of liver abscess as shown in the Army Returns (*vide* Table B) is still twenty-five per cent. Surely we cannot accept that as a final result. I am certain that it is partly due to inexperience resulting from the doctor's temporary sojourn in the country. We go to India, see a certain

¹ A Thesis written and accepted for the M.S., London University.

number of cases and then retire ; some may see many, others a few, every doctor will see one if he is practising among Europeans.

I have myself been interested in tropical liver abscess since first going to India fifteen years ago, and in each station to which I have been posted have tried to see every case of liver abscess that occurred, both in Europeans and Indians, and as a result have seen about a hundred cases. These have not all been under my care. My chief object has not been to make statistics, which are bound to be unreliable, but to find out, if possible, how the patient came to have an abscess, or why he died—believing as I do, that with emetine properly administered, no case should ever get beyond the stage of amœbic hepatitis.

I have been asked several times by fellow medical officers—"How did you diagnose liver abscess, there are no book symptoms present." My answer is that most of the books refer to the symptoms observed when the abscess is about to rupture, at which stage the patient's life is in great danger. If you wait till this stage is reached, then you will never reduce the mortality below its present level.

It is for this reason I have elaborated into a paper the advice that I have been giving lately to the newly arrived Army Medical Officers in India, and at the same time I have added a few historical notes to show the wonderful difference that sanitation and modern treatment have made in the last twenty years.

GENERAL.

The title with which I have headed this thesis, viz., *Hepatosiis* or tropical abscess of the liver, is a comparatively modern one. It is to be hoped that this name, brought forward in a recent textbook by Dobell, as actually describing the disease, may be ultimately incorporated in every textbook. I have not used the name again in this paper because it has not yet been authorized by the teachers on the subject. I have dealt more fully with this question under the heading *Pathology*.

STATISTICS.

The only statistics I have used are Tables A and B, which are made up from the Annual Returns of the Health of the British Army in India from 1871 to 1919, roughly fifty years. During that time the general health of the Army has been greatly improved, both from the preventive and curative aspects. The only drawback to these tables is that although dysenteries have been divided into bacterial and amœbic, they are still shown under the same heading in the official returns. It is, however, a well-known fact that the vast majority of cases of dysentery in India are of the amœbic type.

For the sake of brevity I am taking as an accepted fact in this article that :—

- (1) Amœbic abscess is caused by the *Entamœba histolytica*.
- (2) That this protozoon can be found in the liver in a large proportion

of cases of the disease; Rogers reported 35 per cent over a series of cases in Calcutta.

(3) That, other things being equal, any increase of the number of cases of amoebic dysentery will be followed by an increased number of liver abscesses, a fact well brought out by Table A.

During the War I was for two years with the East African Field Force, and saw the most severe epidemics of dysentery that I have ever come across. These were all bacillary, and during that time I never saw a case of liver abscess, except in a soldier from India.

TABLE A.

Year		Dysentery		Liver abscess	Year		Dysentery		Liver abscess
1871-80	..	90.1	..	Not given	1905	..	55.9	..	10.5
1881-90	..	49.6	..	..	1906	..	15.2	..	2.6
1892	..	47.5	..	3.2	1907	..	11.7	..	2.4
1893	..	52.5	..	5.8	1908	..	14.4	..	1.7
1894	..	85.1	..	5.5	1909	..	11.7	..	1.4
1895	..	118.2	..	13.0	1910	..	7.7	..	1.0
1896	..	126	..	14.0	1911	..	7.7	..	1.0
1897	..	116.2	..	18.07	1912	..	5.2	..	0.7
1898	..	122.8	..	2.97	1913	..	5.4	..	0.5
1899	..	230.3	..	6.06	1914	..	5.6	..	0.5
1900	..	163.4	..	16.34	1915	..	5.6	..	0.7
1901	..	304.4	..	35.2	1916	..	8.2	..	0.5
1902	..	235.5	..	57.4	1917	..	11.1	..	0.7
1903	..	151.1	..	31.1	1918	..	13.8	..	0.6
1904	..	72.0	..	21.2	1919	..	14.2	..	0.7

TABLE B.—ACTUAL CASES OF LIVER ABSCESS FROM 1911-1919 WITH MORTALITY.

Year	Admissions	Deaths	Percentage	Year	Admissions	Deaths	Percentage
1911	.. 71	.. 33	.. 46.5	1916	.. 42	.. 13	.. 30.8
1912	.. 47	.. 23	.. 49.2	1917	.. 51	.. 13	.. 25.7
1913	.. 36	.. 14	.. 38.8	1918	.. 64	.. 22	.. 35.2
1914	.. 29	.. 9	.. 31.2	1919	.. 49	.. 11	.. 22.8
1915	.. 23	.. 9	.. 39.3				

HISTORICAL.

Amoebic abscess of liver (French, *abcès du foie*; Italian, *epatite suppurative*; German, *tropische Leberabscess*) is one of the oldest diseases known.

It was known to the ancients, and was operated on as far back as the days of Hippocrates.

The earliest records of its association with dysentery occur in the writings of Galen. Morgagni studied its morbid anatomy, and described the characteristic pus.

During the nineteenth century its ætiology has been most fully worked out by the French in Africa and Indo-China; the best known work is by Lereau, who was apparently operating in Africa many years earlier than anyone else, and at a time when his fellow-countrymen in Indo-China were saying that operation was useless.

Work also during this time was carried out by surgeons with the Army in India, and it is in connexion with this work that I am most concerned.

ÆTIOLOGY.

Liver abscess is essentially a disease of tropical and sub-tropical climates. It is stated to be commonest in India and Indo-China, less common in Ceylon, Malaya, Java, Sumatra, and rare in Southern China. In Africa it occurs in Egypt and North Africa, it is rare in West and unknown in East Africa. Rare in United States, West Indies, and British Guiana. It is occasionally found in temperate zones, in Spain, Italy, France and England.

With regard to England, most cases reported have been definitely associated with dysentery contracted in the tropics; one or two cases, however, have been reported in which the source of infection has never been ascertained.

With regard to India practically all the work has been done in the British Army, and in the civil hospitals of the larger towns.

It is generally stated that it is a disease more common in Europeans than Indians, the age incidence is 20 to 40; sex—men more than women in the proportion of 20 to 1. I would put this proportion much higher, as it is very rare amongst European women.

Another important point is that the British soldier is infected out of all proportion to his officers. I can only find case records of three officers and one woman in the last ten years.

After the age incidence, which is now generally accepted, there comes the influence of alcohol; this, after dysentery, is believed to be the most important ætiological factor.

I have been struck by the fact that the patients are not usually the heavy drinkers of the regiment, and I have found that this fact is recognised by many others, both medical and lay.

I myself consider the primary factor is a state of the liver in which congestion is easily caused, it may be by food or alcohol. Every resident in the tropics knows that an amount of alcohol may be taken without ill effect when in full exercise, which is impossible when leading a sedentary life.

I think that chronic dyspepsia with enervating effects of heat are more important than alcohol, though the beer drinking soldier is undoubtedly more liable than the officer and civilian official class.

In an essay on liver abscess, published in the early part of the nineteenth century by Nichols, a Madras army surgeon, I came across the following interesting remark:—

“In the 80th regiment, during our stay at Gilon, I noticed that those of a scrofulous habit, and the tall and melancholy, have suffered most from inflammations of the liver.”

Such a remark, written in the days when the consumption of alcohol was ten times what it is to-day in the British Army, is surely suggestive.

With regard to race, Manson gives the proportion over a ten years' interval as 1—6 between the Indian Army and the British Garrison in India. I find that in the last ten years there has never been a greater

number than twenty-five cases classified in the Indian Army Returns, which would show about the same rate as quoted by Manson.

Operation for liver abscess is, however, not uncommon in the average civil hospital in India, and the disease would appear to have a later age incidence in Indians than Europeans.

With regard to liver abscess in India, the records are those of the British Army in India. No other records are easily available, and they represent the cases most accurately recorded and where the fatal cases always come to post-mortem examination.

These returns are shown in Table A. Whilst it is a fact that liver abscess had a close relationship with dysentery, it was not till 1892 that these diseases were tabulated together.

With regard to liver abscess in India, I think the subject may be divided as follows, taking the last 100 years as a period over which statistics are available:—

(1) The period before 1870 when ipecacuanha was not in general use, and when operation, if performed, was only by the abdominal route and on obvious swellings or old-standing encysted abscesses. The treatment during this period was mostly by saturation with mercury.

(2) The period between 1870 and 1900; this was one in which operations were becoming more frequent, both by thoracic and abdominal routes, and ipecacuanha was beginning to be a routine treatment for amoebic dysentery.

(3) 1900-1919. Ipecacuanha and emetine have become a recognized form of treatment. Operating theatres and staff are provided in every garrison and there is immediate recourse to operative treatment on diagnosis.

First Period.

I only dwell on this period because during it there was produced a small work on liver abscess, in which the writer, with great labour, obtained a record of every case of liver abscess which was published in the medical journals of India in the first half of the nineteenth century.

Every case is given in detail. As no man is ever likely to collect so many cases again, and now that emetine has become a routine treatment for amoebic dysentery, some of his findings, before the use of ipecacuanha and when operations of this type were of grave danger, are very interesting for record and comparison with the cases of to-day.

It must be remembered that the period was pre-Listerian, and also that only mercury was used in treatment.

The book is "An Inquiry into the Statistics and Pathology into Some Points Connected with Abscess in the Liver as met with in East India," by Edward John Waring, Residency Surgeon, Travancore, published in Madras, 1854.

I have read the records of the 400 cases and his deductions; he sums them up as follows:—

406 *Hepatositis (or Tropical Abscess of the Liver)*

1st Series : 300 fatal cases brought to post-mortem.

2nd Series : 81 cases operated on with 80 deaths.

3rd Series : 25 cases of spontaneous recovery.

Males 291 ; females 9. Six only Indians ; 92 per cent between 20 and 40.

Habits temperate, 30·5 per cent ; intemperate, 67·5 per cent.

In seventy per cent of cases liver abscess was diagnosed.

In a large number it was evident that the abscesses were diagnosed post mortem.

The connexion with dysentery was well brought out in connexion with the Second Burmese War.

Distribution—

Single abscess	59 per cent.	Right lobe	67 per cent.
Two "	11 "	Left "	6·6 "
Three or four abscesses ..	9 "	Right and left lobe ..	14 "
Four to eighteen " ..	9 "	Throughout liver ..	16 "
Multiple " ..	12 "		

The nature of the pus is described by Sir James McGregor, a surgeon of the East India Company, in "Annals of Medicine," 1801. The abscesses that came to operation were all operated on by aspiration, which was at first done with a grooved instrument and later with a true cannula. They were all operated from the abdominal route, the transpleural route is not mentioned. Over ninety-eight per cent were fatal, and so much so that the operation was in great disrepute at the time Waring wrote his book.

Spontaneous recovery—sixteen burst into lung and were coughed up, and in the remaining twenty-two the pus was passed per rectum, having burst into the large intestine.

Shoulder pain occurred in forty-eight per cent of cases.

Dysentery, fatal in a large number of cases.

The most important point that I could bring out was the situation of the abscess in the left lobe of the liver in thirty-seven per cent of cases. This will be referred to later, and also the occurrence of acute dysentery at the time of death from liver abscess in many cases.

I think it may be truly said that actual dysentery occurring at the same time as liver abscess is rarely found now and quickly reacts to treatment.

Second Period.

The results of this period were well summed up at the discussion on tropical abscess at the British Medical Association meeting in 1900, where the speakers were mainly from India and the Seamen's Hospital at Greenwich.

The records of the Army show that operation had now become the treatment, but that the mortality of the disease was certainly not less than sixty per cent over all cases.

During this period ipecacuanha was the treatment for amoebic dysentery.

The transpleural route and aspiration by Potain's aspirator also came into use, while the abdominal route fell into disrepute.

The first record of the use of Potain's aspirator that I can find was in 1884, in Braithwaite's "Retrospect of Medicine." Curiously enough, this volume also contains the first description of Bigelow's evacuator, both instruments now an essential part of the equipment of the smallest hospital in the tropics.

Third Period.

The third period shows that operation is now universally resorted to. Emetine has entirely replaced ipecacuanha in the treatment of dysentery and amœbic hepatitis.

Mortality has been reduced to twenty-five per cent in the most favourable years, but the disease still shows one of the highest death-rates of diseases in the British Army in India.

Whilst compared with malaria and enteric fever amœbic abscess is comparatively unimportant, yet it is a disease that would appear to have settled down in the last ten years to a level of 0·7 to 0·5 per 1,000 men in India.

Its ratio was not affected by the increase in 1915-1918 of the white troops in India. During the war the average age of the garrison was nearer 40 than 20, and they were mostly soldiers of weak constitutions evacuated from other fronts. Since 1918 there have been no old soldiers in India. With all these changes the percentage of cases has remained much the same.

As with enteric, it would seem that we have reached for the present an end to the reduction in the number of cases, due in one case to inoculation, and in the other to the universal use of emetine. Progress must, therefore, take the form of a decreased case mortality.

I will now proceed to discuss the disease as seen in India to-day.

Distribution.—It is interesting to note that no part of India seems immune, cases occurring from Madras to Peshawar. No station seems to have ever had an epidemic—in fact, reading through reports, I can find no place particularly mentioned except Secunderabad, and the largest number reported from there was five in one year. In one recent series of forty-two cases it was shown that the disease occurred in thirty different stations, and that twenty-six of these had only one case each. This, to my mind, is the difficulty of the situation. The medical man gets only one or two cases a year, and may even only get two or three in the course of an ordinary tour in India, and therefore many cases may unfortunately not be recognized in the early stages. The points I have noticed myself are that most of the cases occur in hot weather, when the soldier is debilitated, and that in the last ten years actual epidemics of amœbic dysentery are not reported.

It would appear that non-epidemicity is the first important point established, that any of us may get an odd case at any time, and therefore each one of us must be on guard and become acquainted with the disease if success in treatment is to be obtained.

ANATOMY.

The relation of the liver to surrounding structures is most important, and it is necessary to know :—

- (a) The position at which a liver abscess may present.
- (b) The cavities into which it may rupture.

These may be subdivided :—

- (1) Below the diaphragm.
- (2) Above the diaphragm.

(1) *Below the Diaphragm.*

Barnard states a subphrenic abscess may be :—

Intraperitoneal	...	Right anterior, right posterior.
"	...	Left " left "
Extraperitoneal	...	Right " left "

Liver abscesses generally break through in the abdominal region into—

(1) The right anterior intraperitoneal region. This is between the right lobe and the diaphragm, in front of the right corona and to the right of the falciform ligament. It spreads downwards and below the liver.

(2) The right extraperitoneal region.

(2) *Above the Diaphragm.*

The acutely inflamed liver forms adhesions to the diaphragm, which in its turn becomes adherent to the parietal pleura or lung, and thus we get the two common sites for the rupture of liver abscesses into the chest. One or two cases have been reported in which the abscesses have burst into the pericardium.

Cantlie has worked out the most important point of the relation of the inferior vena cava to the liver.

In aspiration there was at one time a great fear of hæmorrhage, and the opponents of aspiration talked of the danger of hæmorrhage and pointed out that the inferior vena cava might be punctured.

I can find no post-mortem of such a case, and in a line from the xiphisternum to the 8th, 9th, 10th and 11th spaces in the anterior and mid-axillary line, Cantlie shows that the inferior vena cava in a normal person is nowhere less than $4\frac{1}{2}$ inches from the skin. As in most cases the liver is enlarged and the ordinary needle does not exceed five inches this accident should not happen. It is still, however, mentioned in book after book. I have never met with anybody who had heard of such a case.

PATHOLOGY.

The necessity of realizing the fact that amœbic abscess of the liver is a hepatosis of the liver and not a true abscess has been so well brought out by Dobell recently, that I have bodily incorporated his description in the second volume of Byam and Archibald's "Tropical Diseases," published

in 1922. It elaborates all the opinions I hold on the subject, and is in my opinion the best description ever written of this disease from a pathological point of view.

I have only to add that I have never seen an abscess secondarily infected. In two or three cases after draining a large abscess for two or three weeks in a septic ward of an Indian hospital I have failed to grow organisms from the pus.

AMŒBIC HEPATITIS—DOBELL—HEPATIC AMŒBIASIS.

A primary infection of the intestine with *Entamoeba histolytica*, accompanied by ulceration, which may or may not be easily visible on naked-eye examination of its mucous membrane, always precedes the invasion of the liver or other organs. Dysentery or other intestinal symptoms of such ulceration may or may not be manifested before or during the formation of lesions in the organs secondarily infected. In all probability the liver is usually infected by way of the portal vein. The amœbæ in the gut wall enter its radicles and are carried by the blood-stream directly to the liver. A possible source of entry is by direct infection from ulcers in the hepatic flexure adherent to the liver. At present there appears to be no good evidence to prove that the parasites can reach the liver by way of the general circulation, the lymphatics, or by any route other than those just mentioned. The condition of the liver in amœbic hepatitis requires further investigation. It is probable that it is similar to, if not identical with that observed in the earliest stages in the formation of a hepatic abscess. When the amœbæ are borne to the liver, they may be able to live there for a time, to histolyze and feed upon its tissue and then multiply. The liver, however, appears to be able to arrest their further development in many cases, and the incipient abscess fails to develop and is later absorbed. In such cases we imagine the patient is clinically a case of amœbic hepatitis. When, however, the liver is unable to deal with the parasites successfully, they continue to multiply at the expense of its tissues, and a hepatic abscess results. It has been stated that greyish necrotic areas, varying in size from a few millimetres to two centimetres, and containing a drop or two of grumous material and amœbæ, are found at post-mortems of fatal cases of amœbic dysentery. These appear to represent the precursors of liver abscess or the hepatic lesions of hepatitis. The factors which determine whether invasion of the liver by *E. histolytica* is followed by hepatitis, abscess formation, or arrest and destruction of the parasites, are still matters for speculation.

The amœbæ, once established in the liver, behave in much the same way as they do in the intestine, causing a coagulation necrosis. An irregular cavity is formed by cytolysis of the liver cells, and increases in size in a centrifugal direction. Several primary centres may then coalesce. The cavity contains so-called liver abscess pus, a viscid stringy matter consisting of dead liver cells in all stages of disintegration, with an admixture of blood, bile, and sometimes true pus. In typical cases, how-

ever, there is no secondary infection with pyogenic bacteria, leucocytes are not present in large numbers—the pus appearing under the microscope as a mass of necrosed liver cells, amœbæ, real blood corpuscles, leucocytes of various sorts, fat droplets, and occasionally hæmatoidin and cholesterin crystals. To the naked eye it appears more or less stained with blood or bile, and is commonly of a reddish or chocolate colour, suggesting the classical comparison with anchovy sauce. The “pus” is, strictly speaking, a result of hepatolysis—not of suppuration. In uncomplicated cases it is bacteriologically sterile. The abscess may increase in size until it seems to occupy most of the liver substance. Its growth is brought about by destruction of the peripheral liver tissues in which the majority of the amœbæ will be found. As it enlarges, the cavity continues to fill with histolysed liver cells, sloughed necrotic tissue and blood. The process advances rapidly, as a rule, and no pyogenic membrane is found—the wall consisting of ragged liver substance. The diseased tissue merges into the healthy with little else than a zone of hyperæmia between them. Round-celled infiltration is commonly seen when a bacterial infection has been superadded. At any time the abscess may be arrested in its development and become encapsuled. The pus then loses its chocolate colour and peculiar viscid consistency and becomes yellow and creamy, and then caseous and ultimately calcified. The walls of such abscesses are often thick, smooth, and fibrous. These retrogressive changes probably begin when the amœbæ, as the result of treatment or some other cause, are killed.”

Blood Changes.—It will be convenient to mention here the work of Sir Leonard Rogers. To him we owe—

- (1) Emetine.
- (2) The injections of quinine into abscess cavities.
- (3) The most complete description of the blood aspect of this disease.

Whilst his work on the first two is well known and revered by all workers in the tropics, his work on the blood aspect is not so often quoted.

In 1903 he made the following observations in an article in the *British Medical Journal*.

Summary.

“(1) Absolute leucocytosis is nearly always found in amœbic abscess of the liver, but in chronic cases with marked anæmia only a *relative leucocytosis* may be found.

“(2) The degree of leucocytosis is very variable, being highest in most acute cases, while a low degree is commonly met with in those cases with an insidious onset, in which repeated examinations may be necessary.

“(3) In acute hepatitis, without suppuration, leucocytosis, both absolute and relative, is nearly always absent, or a slight degree is met with.”

The important points he lays stress on are *anæmia and relative leucocytosis*, which are cardinal signs for operation.

I would go further, and say that in cases where a hepatitis is being treated with emetine and not doing well, an increasing leucocytosis is a sure sign that hepatolysis is going on.

It has helped me to persevere looking for an abscess many times, and I cannot understand why more stress is not laid on this sign in textbooks.

Signs and Symptoms:

There are few diseases that present so many difficulties to the medical attendants. When there is actual bulging of the liver with classical signs and symptoms then the diagnosis is very simple. There are many cases, however, where the signs and symptoms are either very few, or by their extreme vagueness make the diagnosis one of the most difficult in medicine. This is partly due to the situation of the liver, which, although an abdominal organ, has close relation to the diaphragm and thoracic cavity.

First of all it is, I think, necessary to classify the cases, and I have accordingly grouped them in the manner I find most helpful.

Type (1) cases where there is an obvious liver swelling in the right hypochondrium (a chronic case as a rule).

Type (2) cases where the liver is enlarged and shows marked signs of swelling over the right lobe. This may be indicated by mere bulging of the intercostal spaces, or by well-marked signs of pleurisy, according to whether the abscess is pointing in the upper or lower pole of this lobe. (This may be an acute or chronic form.)

Type (3) cases where there is remittent fever and no marked enlargement of the liver, but where there are signs of inflammation. Movement is little impaired, but the patient is obviously ill. Always acute.

First of all I will give the most familiar general signs and symptoms common to all liver abscesses, and I cannot do better than begin by quoting word for word a description by the late Mr. W. Johnson Smith, of the Seamen's Hospital, Greenwich, given at the annual meeting of the British Medical Association in 1900. In a paper read before the Tropical Disease Section, he gives the signs and symptoms as follows:—

“The patient, generally between 25 and 45 years of age, has resided in a hot country and has suffered there from dysentery. There is tenderness of the liver, varying in extent from time to time, but always more marked in one spot than another.

“There is decided and well marked shoulder pain and signs of gastric irritation.

“The patient is emaciated and presents a peculiarly sallow, though not jaundiced, complexion and is depressed and mentally torpid.

“The temperature is irregular, with more or less tendency to the remittent type.

“There is, I believe, a characteristic position—patient lies on his back with chest raised and low limbs flexed. If, with these symptoms the patient presents a fluctuating swelling in the right hypochondrium, nothing can be easier.

"If we find these symptoms with marked bulging of the intercostal spaces of lower ribs of right side, then again the diagnosis is easy.

"The most difficult cases are those in the left lobe of the liver"

Such an account shows, to my mind, appreciation of the disease as represented in the patient, and roughly coincides with the classification I have adopted. Taking the general signs and symptoms in order, we find:—

Temperature.—Varies greatly.

(1) It may be quotidian, the morning temperature being normal or sub-normal, evening up to 102° F or 103° F.

(2) Irregular fever with rigors is quite as common, the signs being accompanied by drenching sweats.

(3) In chronic abscesses there are definite afebrile periods, which are apt to mislead.

General Appearance.—There is an earthy colour without jaundice, which to my mind is very suggestive. It is quite different from the look of a typhoid patient and from malarial cachexia and is a characteristic of hepatitis.

The patient is generally depressed and melancholy with a varying degree of gastric disturbance. He loses weight very rapidly.

Attitude in Bed.—The patient who has an abscess in the right lobe takes up a characteristic attitude. He lies on his back or the affected side with legs flexed and curled up in a position which is almost diagnostic. The patient with a left lobed abscess often has rigidity of the right rectus.

Pain.—Pain, when the abscess is large, is severe, situated in the liver and is referred, in some cases, up to the right shoulder.

It must be remembered that only cases where the diaphragm is involved can get referred pain in the shoulder via the phrenic nerve.

There may be a large abscess in the hypochondrium without pain being marked.

Tenderness over the liver area is always a marked feature, generally at one particular spot. This I regard as the most important point. Repeated examination will always produce amongst the general tenderness one painful spot. With regard to pain, too much emphasis must not be laid on the presence of pain in shoulder. Pain was present in the shoulder in about 40 per cent of cases in my experience, and I find this an average figure in all series of cases published.

Enlargement of the Liver.—The liver may be enlarged downwards, but this is not common except in those cases where the abscess is chronic, and has burst into the surrounding tissues and become encapsuled.

Enlargement inwards is not common in these days of small abscesses. Enlargement outwards with filling and bulging of the intercostal spaces is still one of the commonest signs. Enlargement upward in any marked degree is not so common as one might expect, and is always associated with thoracic symptoms.

Altogether the liver enlargement is not so helpful as one could hope. When there is a bulging swelling of the liver, the diagnosis is one of the easiest. The liver is often very slightly enlarged, and moves quite well on respiration where an abscess is present.

X-rays.—Here again we are met with a disappointing result. X-rays only appear to give results when the other signs and symptoms clearly point to an abscess of the liver. In the more difficult cases it is surprising how well the liver moves and how little it is enlarged. There is, however, one sign that I have found helpful. In those most difficult cases of abscess in the upper part of the left lobe, sometimes during the *pre-suppurative stage of amœbic hepatitis, there is a fixation of the diaphragm with increased respiratory movements and no thoracic lesion.* This is an important sign when present, and should always make one suspicious.

The changes in the blood have already been described.

I will now proceed to describe three cases in my series which were, to my mind, typical of more important types.

Type I.—An Indian, aged, anæmic and emaciated, very asthmatic, came to hospital complaining of a lump in his right hypochondrium. He had slight remittent fever. There was a history of blood and mucus in the stools ten years before.

He had, to the outer side of the gall-bladder, a tense elastic fluctuating swelling about the size of an orange. This swelling could not be separated from the liver. He said the swelling had gradually been getting larger. He had done no work for six weeks. There were few symptoms excepting debility and loss of appetite.

A diagnosis of a liver abscess was made. An anæsthetic was given and an incision was made over the swelling. Adhesions were found, as is usual in these old cases, between the peritoneum and the liver. An incision into the swelling was followed by evacuation of one pint of the typical anchovy sauce-like fluid. As the cavity was very large it was drained and healed in twenty-seven days.

The prognosis in these abdominal cases is now very good. I have now opened fourteen cases by this route and have had thirteen recoveries; the fatal case being one which had tracked down to the lumbar region and formed a swelling which was at first thought to be an appendix abscess. This type presents little difficulty in diagnosis and the cases are very often chronic.

Type II.—An officer, aged 32, on service in East Africa, gave a history of amœbic dysentery on two occasions during his twelve years in India. He was on telegraphic construction work, and had suffered from fever for three weeks and was dosing himself with quinine, thinking he had malaria, which he had (ninety per cent of us in that part of East Africa got malaria whilst there). Eventually he became so ill that he was compelled to come to hospital. On admission to hospital he had a temperature of 103° F., a very sallow complexion, continuous vomiting, very tender liver, moderately

enlarged, with distinct filling up of the intercostal spaces. He lay in bed on the affected-side, with his right leg drawn up. He was obviously very ill and it seemed surprising that he could have done his work so long. He was very emaciated. Despite the presence of malarial parasites in the blood, we decided he had a liver abscess. He was operated on by another officer. Two pints of pus were aspirated through the ninth intercostal space, in mid-axillary line, and emetine was injected. The same night he developed tetanus and died in twenty-four hours.

I have mentioned this case because, though a typical case of liver abscess, it is the only case in my experience where the patient died of another disease immediately after operation, and thus the result of operation could be verified.

Post-mortem.—We found that a pint of pus had been left behind and that he had a large single abscess both in the right and left lobe. Even if he had not had tetanus, I do not believe he would have lived, as the abscess was not evacuated. I shall show, under Treatment, that these large abscesses can never be treated by aspiration through intercostal spaces.

Type III.—I was asked to see a soldier, aged 26, in consultation. He had been ill for a fortnight in hospital, and had, during that time, always had a temperature 99-101° F. He had been first treated for malaria, then suspected of enteric. All tests being negative, he had been explored twice with a needle for liver abscess. When I saw him he seemed in pain. His leg was drawn up and he lay on the right side, curled up. He looked very sallow. The liver was not markedly enlarged. The right rectus was rigid and the liver was most markedly tender in the epigastric region. Though tender all over, it was most particularly marked in one spot. Blood count showed a leucocytosis. I made a diagnosis of abscess of the left lobe and eventually after nineteen efforts with an exploring needle evacuated a small abscess, emetine was injected and in fifteen days the man was sent to a convalescent depot.

These are the difficult cases, and under treatment I shall deal more fully with them.

Whilst these three types of cases, with modifications, cover all the ordinary types, we must not forget the cases which cure themselves by spontaneous recovery, and those that come to the post-mortem room undiagnosed. With regard to the former there are the cases which cough up a liver abscess. This is the commonest chest complication, and statistics show that twice as many abscesses rupture through the diaphragm into the lung as into the pleural cavity. They are the most difficult group of cases and will be dealt with more fully under Treatment.

I had one case which died three days after the abscess ruptured without any apparent reason. He was found to have a large abscess in the right upper lobe. The lung was adherent to the diaphragm. The lungs were secondarily infected. I wish now I had drained the abscess at the time he started coughing up the abscess.

The Large Intestine.—Several cases are reported in the literature of liver abscess rupturing into the large intestine, but I can only find one in which it cleared up and the patient recovered.

It will be convenient at this point to mention the organs into which at post-mortem examinations liver abscesses have been found to burst : lung, peritoneum, pleura, stomach, duodenum, colon, lumbar region, vena cava, kidney, pericardium. Very rarely they burst externally.

None of these are common except the lung. In my experience I have found none, and I consider they are tragedies that we hope by diagnosis and modern means of treatment to avoid.

Lastly, at this stage, we must mention the cases with no apparent localizing symptoms at all.

It is extraordinary how one ounce of pus in the liver will make a man ill, and how another man will do his work up to a few hours before death, and post mortem will be found to have a large abscess. In the largest recorded two pints of pus were found, post mortem, in a man who had been on duty up to twenty-four hours of death.

I have seen a post mortem of a man who died forty-eight hours after being admitted to hospital, diagnosed as enteric fever. The liver showed a single hepatic abscess containing twelve ounces of typical grumous material.

DIFFERENTIAL DIAGNOSIS.

I have taken this list out of a well-known textbook on tropical diseases.

“Liver abscess must be distinguished from malaria, gall-stones, sub-diaphragmatic abscess, syphilis, tubercle, enteric fever, undulant fevers, hydatids, kala azar, hepatic coccidiosis, ascaris liver abscess, septic abscesses of liver, suppurative cholecystitis, actinomycosis, pyelephlebitis, pyelitis, ulcerative endocarditis, malignant disease of liver.”

The very list is so long that it is hard to realize which is the most important, and it makes one wonder how many of them were seen by the author, and how many copied from another textbook.

I think, here again, to get at the truth, we must take liver abscesses according to the clinical grouping.

General.—All liver abscesses may be mistaken in the early stages for malaria and enteric fever, and are extremely difficult to diagnose in the earliest stages.

I made a particular point in the case of five British soldiers, who were in a surgical ward, strongly suspected of having liver abscesses, when I saw them, to find out how they got there. It is the rarest thing to find a liver abscess admitted straight to a surgical block of a hospital.

I found that all of them had been admitted first to a malaria ward, suffering from shivering and fever. The microscope revealed no parasites, and they were moved. Two of them went to the enteric observation block, until enteric was ruled out, the other three went to the surgical

block as suspected liver abscess. This is a very common sequence of events.

It must be remembered that, as in case two above, they often have got malaria as well, so too much stress must not be laid on finding parasites.

With regard to gall-stones, I think this disease must be very rare. It is a most uncommon disease in the Army, where the soldiers are from 20 to 40, and is also uncommon in Indians, and its sex incidence in India is most certainly in women, whereas liver abscess is very rare in women, and the history is totally different.

The only other diseases I have met with in that list are malignant disease and tubercle. I met with the malignant disease in an old Indian; his son, who was a Government assistant surgeon, implored me to operate and I must say I thought he had a liver abscess. I cut down on to this large rounded mass in the right hypochondrium, and found it was a growth.

Tuberculous disease: a case that, for a long time, was suspected as liver abscess, proved to be a tuberculous caries of spine. The connexion, I cannot explain, but the liver was enlarged and tender, and there was shoulder pain. He had pleurisy and fluid just above the right lobe of the liver.

I can find no record in literature of the symptoms of a case of hepatic coccidiosis or ascaris liver abscess, so I do not know how one would differentiate them in life. The specimen in the Royal College of Surgeons Museum has a cyst wall.

Pyæmic abscesses of the liver are as a rule small, and multiple and constitutional changes are very severe.

Echinococcal cysts of the liver. It would appear from a description given to me by a leading Australian surgeon, that the places where an echinococcic cyst forms in the liver are the same as those of liver abscess. We must, therefore, rely greatly on the history.

The remainder hardly come into the picture with the exception of the duodenal sub-diaphragmatic abscess. A liver abscess may burst into the sub-diaphragmatic pouches. The diagnosis may not be easy, but fortunately the treatment is the same.

TREATMENT.

This we can divide into: (a) Medical, (b) Surgical.

(a) Medical.

This resolves itself into a discussion of the use of emetine.

This is not the place to discuss the dosage of emetine in dysentery, or the superiority of emetine bismuth iodide. That emetine does kill the amoeba *in situ* is an accepted fact, therefore we may lay down that the properly treated amoebic dysentery should never come to a liver abscess, and that the first step in reducing mortality from liver abscess is the effective treatment of the dysentery. I consider this is very true. I do not

believe in the existence of cases which have not had an attack of amœbic dysentery. In a true case of amœbic hepatitis there is always a history of mucous diarrhœa, even if there has been no actual passing of blood. The main point that we are concerned with is how long we should treat a case of amœbic hepatitis by emetine injections alone. It must be remembered that some cases with most marked signs of abscess formation will resolve under emetine.

My experience is that if a suppurative amœbic hepatitis is going to clear up, then from the very first injection there will be a marked improvement. Pain is relieved, the patient feels better, the drenching sweats stop and the temperature falls. I am of opinion that unless there is a marked improvement by the third injection, emetine alone is not going to cure. The dosage I employ is one grain of the hydrochloride or hydrobromide of emetine every twelve hours, or half a grain every six hours, by subcutaneous injection. Whilst one grain is generally considered a maximum dose, I have never seen it do any harm. The harm that is done by emetine is more in its continued use. It must, however, always be watched, as some patients quickly suffer from emetine poisoning.

(b) *Surgical.*

(1) Exploratory puncture: (a) Transpleural route with or without resection rib; (b) abdominal route.

(2) *Aspiration* after exploratory puncture and injection of quinine or emetine; (a) and (b) as above.

(3) *Drainage* after exploratory puncture; (a) and (b) as above.

Under *Section History* I have described the earlier procedures at operation, and I think No. 1 of the headings above may be considered historical. I do not think anybody would be satisfied in dealing with a liver abscess by simple puncture at the present time.

No. 2 (a).—*Aspiration* should be confined to small abscesses. Cases where there is marked bulging of the ribs, or in which there is a large cavity shown by the mobility of the needle after entering the liver, are better drained.

Mobility of the needle is one of the most important points; *when the point of the needle, after entering the liver, can easily be elevated or depressed thirty degrees or over, then I believe there is present an abscess cavity that no amount of aspiration will ever drain completely.*

The liver wall does not quickly retract down after evacuation, and it is an easily demonstrable fact that a sac of more than a certain diameter cannot be emptied by a narrow tube used in aspiration through the thoracic wall.

Site of Puncture in Exploratory Puncture in Transpleural Route.—The site of election is, I think, the eighth or ninth interspace in the mid-axillary line. In the post-mortem room I have inserted as many as twenty needles at this point in every direction, and then cut down and found that there have been very few parts of the right lobe not reached.

It has also the advantage of being a place easily drained if necessary.

The method of attacking a liver abscess from the back, still mentioned in some textbooks as a possible route, is very dangerous. The needle might be passed into the inferior vena cava, and it is also a bad place to drain from the point of the patient's comfort and nursing.

Should a Rib be Resected?—If drainage is to be carried out a rib must be resected. I quite agree also that the small abscess cavity, easily accessible, can be aspirated and injected with quinine and emetine by puncture through the chest wall. At the same time there are cases where, despite repeated punctures, no abscess is found.

Type 3 in my series well illustrates this: the patient in that case had been explored on several occasions. The diagnosis seemed to be pretty certain. We took out a rib and, as I have mentioned, we punctured nineteen different times in various directions before we found the abscess. We evacuated four ounces of pus, injected one grain of emetine in ten cubic centimetres of normal saline, and closed up the wound; the patient's temperature and general condition improved at once.

It is, therefore, sometimes necessary to resect a rib, because one cannot hit off the abscess. The question now arrives, if one has resected a rib, should one drain or aspirate? Personally I take the view that if one has had to resect a rib, it is better to drain for a day or two.

A most important point is never to take out the exploring needle, but to cut straight down on it. It is sometimes most difficult to find the abscess again.

With regard to the operation of resecting rib, the textbooks of advanced operative surgery make it a most complicated operation, advocating sewing of the pleura to chest wall and diaphragm to prevent leakage. I consider this quite unnecessary. In the case of large abscess which has been located by exploratory puncture, there are, as a rule, already firm adhesions between the very inflamed liver, diaphragm and pleura. In other cases it is much easier to pack the opening into the pleura round with gauze.

With regard to quinine injections, Rogers claimed to have greatly improved his results by injecting a weak solution of quinine salts into the cavity after evacuation. He only claims for this method that it kills off any live amœbæ that may be present. Personally, I inject emetine itself, using one grain in ten per cent of normal saline. Emetine itself is a much more powerful amœbicide, and therefore it seems a more rational treatment. Many of the most eminent surgeons in India are, however, still using quinine. It is useless to employ injections unless the abscess cavity has been emptied.

Anæsthetic.—The question of an anæsthetic. I do not think it is justifiable to puncture a liver without an anæsthetic. It is a most painful proceeding, and the restlessness of the patient makes the journey through skin, muscle, pleura and diaphragm much more difficult. I would go further than this and say that you should never puncture without being

prepared to operate. You may find drainage necessary because the abscess is so large, or having located an abscess, for various reasons you may not be able to get the pus through your needle. In these cases immediate operation is essential, because it is a well known fact, as mentioned above, that if you take the needle out you may often have great difficulty in locating the abscess again.

Instruments.—The operation of puncture and evacuation is almost universally done with some form of a Potain's aspirator with a Sprengel's pump through a bottle. Such sets are essential equipment of all hospitals in the East, and it should be seen that the calibre of the tubes is sufficient. Some of the sets contain tubes whose calibre is such that it is impossible to evacuate the thick grumous variety of pus, very often met with in chronic abscesses.

In the transpleural route there is lastly the question of operation in those cases in which the abscess has burst: (a) into the lung; (b) into the pleural cavity.

(a) *Into the Lung.*—In former times it was thought that a case that had burst into the lung, and where the patient was coughing up the pus, should be left alone. I am of opinion that this is too risky a situation, and that the proper line of treatment is to find and deal with the abscess through the ordinary thoracic method of puncture in the ninth space. I have only seen one case done that way, and he recovered.

I have seen one death from an abscess left alone. I should always open one myself, but not for a few days after the patient had started coughing up the pus, as there is a good deal of reaction to start with.

(b) *Into the Pleural Cavity.*—Under this heading controversy has ranged round, whether the liver abscess should be explored through the empyema opening, or whether a new opening should be made down over the liver itself.

The consensus of opinion is, I think, that it should be reached by opening up the empyema opening. These cases, whilst fortunately few in number, seem always to become secondarily infected, and the mortality is very high.

Abdominal Route.—This is reserved:—

(1) For definite abscess of liver pointing below the costal margin.

(2) For those cases of abscesses in the left lobe where there is a tender point in the left epigastric region, and which are reached with great difficulty by the transpleural route.

(1) This operation must always be done through an incision and the peritoneum packed off with gauze. It seems to me an unjustifiable procedure to puncture into the abdominal cavity without seeing what you are doing, and securing the shutting off of the peritoneum. Far from being the dangerous proceeding stated in textbooks, I always consider the abscess which is pointing below the costal margin as the most favourable from a prognostic point of view.

I add this proviso, that it must be treated as a set abdominal operation, and that the abscess must be always drained. One cannot afford the risk of an abscess filling up again in this region.

I have had experience of twelve cases, which were all very large abscesses, and which one could not have aspirated at one sitting.

(2) This route for exploratory puncture is not a favourite one, though I think a perfectly safe one. A small incision about $1\frac{1}{2}$ in. long should be made about 2 in. from the middle line on the right side immediately below the costal margin and over a prominent part of the left lobe. Tenderness will generally have been located over this part. The abdominal cavity should be packed off with gauze and the liver explored in an outward and backward direction. It is far and away the easiest route to the left lobe, and abscesses of the left lobe cause the high mortality of liver abscess. They give rise to few of the classical symptoms, and are with great difficulty reached from the costal region, as is easily understood.

SUMMING UP.

I know that it may be said there are few new statements and facts in this thesis. I may, however, claim that a review of the literature, before and after the introduction of emetine, and one's own experience, show that liver abscess must now be looked at from a new perspective. The diagnosis has become even more difficult, and the typical cases are not so common.

I would sum up my findings as follows:—

The disease is irregularly distributed in the tropics.

It has definite relation to amœbic dysentery, and is definitely caused by *E. histolytica* in the liver substance.

Whilst the treatment by emetine has reduced the incidence and mortality tenfold, it has still a high mortality rate.

In India it is much more common in men than in women.

Whilst alcohol is a most important factor, debility and congestion of the liver are also predisposing causes.

Distribution is most irregular in India, and it may occur at any season. That, as a result, the chances of missing cases are very greatly increased.

Unlike before the days of emetine, it is now rare to find abscesses and acute dysentery at the same time. They are generally sequelæ of dysentery.

There is no royal road to diagnosis. The train of symptoms is various, and little aid is obtained from X-rays and chemical tests.

A history of dysentery, a muddy complexion, a remittent septic temperature, a tender liver, drenching perspiration, a relative anæmia and leucocytosis are sure signs of liver abscess. Shoulder pain is not so important a sign as textbooks suggest.

When a liver abscess is diagnosed, operative procedure must be continued until it has been evacuated.

If emetine does not clear up the hepatitis, it should be treated by surgical means at a very early date by one of the methods described above.

The causes of failure in order of rarity are:—

- (1) Non-diagnosis, especially of abscess of left lobe.
- (2) Incomplete evacuation.
- (3) Secondary infection, by evacuation into the chest or abdominal cavity.

In this disease, as Moynihan has so well expressed it, "we should be surgeons only by compulsion," and the complete cure of the dysentery and the prevention of amœbic hepatitis should be our aim.

Since completing the above paper, which was written mostly in India, my attention has been drawn to the recent Lettsomian Lectures by Sir Leonard Rogers.

It is a matter of satisfaction—and a great stimulus—to realize that, in an entirely different part of India, the writer has been working along the same lines as so great an authority on tropical diseases.

HÆMATOPHAGY AND HÆMETABOLY AS A NORMAL FUNCTION OF VARIOUS TYPES OF TISSUE-CELL.—II.

By H. M. WOODCOCK, D.Sc.LOND.

Fellow of University College.

THE GROWTH OF THE MAMMARY GLAND DURING THE LATER STAGES OF PREGNANCY, AND THE FORMATION OF COLOSTRUM, WITH INDICATIONS AS TO THE FORMATION OF MILK FAT.

(Continued from p. 358.)

(2) THE FORMATION OF COLOSTRUM.

AFTER a period of rapid growth and increase, rendered possible by this assimilation by the cells of the hæmoglobin, the epithelium begins to settle down; it assumes a more quiescent appearance and begins to change its mode of exercise of hæmetaboly. This function now serves to form the colostrum. The epithelial cells still continue to develop around¹ and enclose the blood elements, but the altered hæmoglobin now persists in the form of masses of varying size, in the enclosed spaces, i.e., the lumina of the alveoli, as these become constituted (figs. 31 to 36 show the early stages in this colostrum formation). In the lower part of fig. 31 is seen a loose strand or cord of cells, rather like a curved finger, which is becoming hollow or alveolar by the simple process of surrounding corpuscles or cells as it extends (towards the right). The reference *hgb.* indicates a small mass of "free" hæmoglobin, representing two or three corpuscles. A similar mass, included in what is now becoming the lumen of the strand, is indicated by the left-hand arrow *col.* The right-hand arrow *col.* points to either (probably) a single included corpuscle, or a small clasmatocyte, such as is seen free at *cl.* (I may briefly mention here, although I deal with the point more fully subsequently, that the clasmatocytes and also other cells can be metabolized into colostrum, at times on a considerable scale.) Figs. 32² to 34 show a similar

¹ I do not mean to imply of course that all multiplication has ceased. As I pointed out in my cancer paper a given "meal" (supply) of blood probably serves for many divisions, during which the nuclei, as they use up their reserve of iron and chromatin, gradually become reduced from the "giant" condition to the size and appearance characterizing the nuclei of "resting" epithelium.

² This figure (32) is from a section of material taken from a guinea-pig which was inoculated subcutaneously in the abdominal region with a solution of indian ink, on three successive days prior to its being killed. The connective-tissue in the immediate neighbourhood of the mammary glands appears quite black; and in sections the cells are seen to be laden with ink-granules. On the other hand, in sections of the gland, scarcely any ink-granules are contained in the cells, showing that there are extremely few reticulo-endothelial elements. In the field, for example (as in many others), there are none at all. This is confirmation of the view I have taken with regard to the epithelial character of the migratory cells.

condition of the envelopment of corpuscles, or small masses of hæmoglobin formed by the fusion together of a few corpuscles, by the epithelium.

It will be asked on what grounds do I maintain that this colostrum material in the lumina of constituted alveoli is modified hæmoglobin? Leaving one or two reasons for discussion later on I give here the following considerations. In the first place, the smallest masses of colostrum seen are invariably the size of a single corpuscle, just as I found to be the case with the smallest masses of colloid [8]. There is *not the least sign* of the "secretion" of this conspicuous, intensely staining substance by the epithelial cells themselves. The sections from which these figures were taken were all stained with iron-hæmatoxylin and eosin. By this combination the corpuscles appear either all black, or with the central part (to a varying extent) black and the peripheral portion red, or, less frequently, altogether red. This variation depends partly (though not altogether I think) on the degree of differentiation, i.e., the extent to which the hæmatoxylin has been extracted from the section. I dealt with this point in my account of the Kurloff bodies [7], to which, with the accompanying figures, I would venture to ask those interested to refer. Now, the small masses of colostrum (*col.*) agree entirely in appearance and staining with the unmistakable red corpuscles. The substance is homogeneous (at this stage), that is to say, there is no question in this particular case where hæmoglobin is concerned, of nucleus and cytoplasm. The central part, to a varying extent, is black and the peripheral portion red (that which appears lighter in the figures), for the same reason that the corpuscles show this difference—cf. fig 34, *r.c.*, also figs. 15 and 16, where the point is nicely shown.

Figs. 35 and 36 are from consecutive sections. In this case, the hæmatoxylin was a trifle too much extracted and the sections were rather strongly stained with eosin. The corpuscles are dark red-pink in tint; though they appear almost black in the figures there is none of the black stain actually left in them. But in some of the masses of colostrum there is just a trace of black persisting. Fig. 35 shows a strand of epithelium, in the form of an inverted V, beginning to open out into small alveoli, which has almost enclosed a small mass of hæmoglobin (the upper arrow, *col.*), and just below, a separate corpuscle (*r.c.*). The next section (fig. 36) shows loose epithelial cells (*ep.*) which will eventually complete the wall around these masses and thus another alveolus will be constituted. Such a recently completed alveolus is also seen on the left, where *col.* indicates the altered hæmoglobin in the lumen. This has an elongated, streaky appearance, representing in all probability the form in which the corpuscles "ran together" in the original blood-channel, when they came under the action of the epithelial ferment. Figs. 37 to 40 also represent the corresponding fields in a series of sections and show how these hæmoglobin masses are formed in a blood-channel, as this becomes surrounded at some point by the spreading epithelium. The reference (*a*) indicates such a mass

cut partly in two sections (figs. 38, 39). It will be noted how, at one level (fig. 37), there is a wall of epithelium adjacent to it, and at the opposite level (figs. 39 and 40) migrating epithelial nuclei (*ep. N.*) are enveloping the capillary in the immediate neighbourhood. The reference (*b*) is to a similar little mass completely enclosed.

Further, just as was the case with the colloid of the thyroid, so in the case of the colostrum, the same general agreement in staining appearance with the corpuscles is seen also after the Ehrlich-Biondi-Heidenhain method (cf. figs. 41 and 42). The former is from a section in which the fuchsin element of the stain has been well retained. (The green-stained nuclei of the cells are, unfortunately, faint, because a green screen was used to emphasize the mauve; cf. the corresponding fig. 11 in my thyroid paper.) On the left, running in a vertical direction, is a channel containing numerous corpuscles; on the right is a capillary cut transversely. Some of the corpuscles are a lighter tint, others are darker; and just the same shades of mauve are shown by the masses of colostrum of varying size. Similarly, fig. 42 is from a section in which the orange element predominated (though a very useful combination, this is a most capricious one). And here the corpuscles are all yellow, while the masses of colostrum are yellow to yellowish-orange, according as to whether they are small or large. The descending reference *col.* indicates a "free" little mass of colostrum, and just to the left of it is a compact clump of corpuscles (*corp.*).

The Question of the Iron.—On several occasions I have pointed out that, as MacCallum first showed, the iron-hæmatoxylin stain gives a most useful indication of the presence of iron in appreciable amount. Elements that markedly retain this stain contain a marked amount of iron. Incidentally I may mention that I consider eosin also affords a useful criterion in this respect, at any rate, as regards hæmoglobin and its derivatives. But my main point is that, wherever the definite chemical test for iron, namely the potassium ferrocyanide reaction, is applied, the results obtained are in absolute agreement with the indications furnished by iron-hæmatoxylin. The only proviso is that where the iron is "masked" in a complex organic combination, as in hæmoglobin, for example, it must be "freed" before the reaction will be successful. And the more completely it is "unmasked" the stronger will be the blue colour. Hence the reason for the prior treatment with hydrogen peroxide,¹ as mentioned under "Technique." Fig. 43 shows a number of colostrum-containing alveoli and a few odd corpuscles. The section was not stained in any way. Apart from the cell-nuclei, the chromatin of which is blue, the only other parts definitely blue are corpuscles and, especially, the colostrum. In the case of the minute masses of colostrum, representing a single blood-corpuscle (as, for instance, at *col.*,

may be mentioned that there is no question of this prior treatment introducing an fallacy into the result. To test the point, some "perhydrol" was added to the potassium ferrocyanide + dil. HCl mixture and left for three or four hours; at the end of this time there was no blue colour whatever present.

fig. 43), the colour is of about the same depth as it is in the "free" corpuscles (*corp.*); but in the larger masses the colour is very pronounced. Remembering that all the dark masses in the figure are a strong blue colour, can there be any remaining doubt as to the occurrence of iron, in considerable measure, relatively, in the colostrum? And whence can this iron be derived except from those elements known to contain it in an adequate amount, namely red corpuscles (the hæmoglobin) and cells (the chromatin of their nuclei)? It is stated in textbooks of physiological chemistry, e.g., Hammarsten, that the plasma itself contains the merest traces ("Spuren") of iron, if, indeed any at all can with certainty be detected therein. Now I have tested this point for myself by the above micro-chemical reaction. Fig. 44 shows a field from a thick blood film, which was fixed wet, immediately after being made, so that all the plasma was coagulated. In the clear areas, where there are no corpuscles, there is no sign of blue colour; therefore, there is no appreciable amount of iron, at any rate in organic combination, in the plasma. I must say I think this evidence detailed above is almost conclusive that the colostrum material is formed from the metabolization of red corpuscles and cells by the ferment secreted by the glandular epithelium.

Digestion of Cells.—So far I have considered mainly the blood elements in this connexion. But at times the epithelium also surrounds cells of the reticulo-endothelial system in the neighbouring ground substance, particularly clasmatoocytes (or plasma cells); these are then also digested and form colostrum material. I have no indications that the epithelial cells themselves assimilate this material derived from other tissue-cells—an interesting and important point. Figs. 45 and 46 give a general idea of the process. In loose areas where the epithelium is gradually spreading, "free" clasmatoocytes are not infrequent. The distinctive appearance of these cells (*cl.*) has been above noted (p. 344). Some of these show already the first stage in alteration, probably as a result of the action of the approaching epithelium. The cytoplasm becomes more coarsely granular and has a more broken-down appearance and the nucleus tends to become dense and pyknotic (cf. the upper arrow, *cl.* in fig. 45). In both figures *cl*₁ indicates such cells just becoming surrounded by clumps or cords of epithelial cells; and *cl*₂ shows such an altered cell now completely enclosed by the epithelial wall and lying in the newly-formed lumen of the alveolus. In a sense, therefore, such a lumen represents nothing more than a large digestive "vacuole" (cf. the behaviour of the megakaryocytes, figs. 7 and 8 in my first paper [7]). Finally, the nuclear material becomes fragmented, the iron-containing portion appearing as dense black granules of varying size. Fig. 45, *cl*₃, shows the result of the alteration of two or three such cells in the lumen; and the same stage would shortly have been reached in the alveolus indicated in fig. 46, when the material *cl*₁ and *cl*₃ is mingled together in the general lumen.

The development of an acinus or alveolus may thus result from the

joining up of cell-morulæ into a cord or finger, which becomes hollowed out as the "digestive vacuoles" run together to form, ultimately, one continuous channel. Such cords or young acini are seen in figs. 47 to 55, traced through a complete, uninterrupted series of sections. One, indicated throughout by (A), both starts and ends as a few cells; that is to say it is as yet independent, not being connected with any other alveolus or ductule. Another (B) is also seen just commencing (fig. 47), but this ends its separate course by joining up with another on its right (fig. 55), both being then only cell clusters. This cord also ends, I think, a couple of sections later, but unfortunately I cannot be quite sure of the point because there is a faulty section here. It will be seen that the alveolus (A) has one hollow portion containing, in figs. 50 and 51, colostrum formed by the inclusion of clasmatoocytes. In fig. 50, indeed, the wall is hardly complete, because an additional clasmatoocyte, in the early stage of alteration (cl_1), is just being enclosed. The alveolus (B) begins as a few cells, then, in fig. 48 is seen containing a little lumen, with a completely broken-down clasmatoocyte (colostrum) cl_3 , and also in the very act of enclosing another (cl_1), the epithelial cells being elongated around it; it then becomes a solid cord again (figs. 49-51), and then again opens out, containing colostrum, and finally ends as a solid cord. I think these examples are very instructive as showing how alveoli may in certain cases originate.

Other references indicate features similar to those I have already dealt with. In fig. 45, the ductule (or long alveolus) is seen containing a large mass of colostrum material, resulting from altered hæmoglobin ($hgb.$). This represents a big blood-channel surrounded by an epithelial wall, as was discussed above in connexion with figs. 10 and 13. At this later stage, the epithelium being now constituted, blood on again passing into the lumen is transformed into colostrum; it is *not* assimilated by the cells themselves. The upper reference, $hgb.$, in fig. 53, and the same on the right in fig. 54, indicate "free" little masses of hæmoglobin resulting from the fusion of several corpuscles. Minute portions of these two masses are seen, respectively, in fig. 54 (immediately to the right of the little bracket indicating epithelial nuclei ($ep. N.$)), and in fig. 55, labelled $hgb.$. A similar little mass, enclosed, as colostrum, is seen in fig. 53 (the reference $hgb.$ at the left). In this early stage colostrum resulting from hæmoglobin is always homogeneous and has a very sharp, regular contour, whereas that resulting from digested cells is more irregular, granular and has conspicuous little black portions representing the iron of the cell-nuclei. Again I say, nowhere, at this early stage, is there any indication of the colostrum being produced by "secretion" from the epithelial cells.

As I pointed out before, here, too, now and again, epithelial cells themselves are seen in the lumen; these have, in all probability, become included as two adjacent hollow spaces in a cord become continuous by the obliteration of the separating "partition" of a few epithelial cells. Such included epithelial cells were shown in fig. 14, and are seen also in fig. 56,

from one of the sections of this series. Now, it might be said, could not all the included cells I have described above be, in reality, epithelial ones which were degenerating and undergoing necrosis? I have very carefully considered this point and am confident that this is not the case. In the first place, on general grounds, it does not seem likely that young, active epithelial cells, in these cell-cords which are becoming definite alveoli, should break down, *on such a comprehensive scale*, where there is no occasion for them to do, i.e., except in the case where they prevent the formation of a continuous lumen. The epithelium is in an entirely different phase now from what it is in later on, when portions of huge swollen-out cells are cast off into the lumen during the later period of lactation. Then the epithelium has ceased its growing activity, and the next thing will be retrogression. Here the epithelium is still extending, at the expense of the connective-tissue, etc., and what more is like Nature's known methods of operation than that these plasma-cells should be *utilized* as the invading epithelium reaches them?

Again, as I have indicated, all stages in the transition from clasmato-cytes of the ordinary appearance to such included cells can be found. And appearances such as are instanced in fig. 48 are not difficult to find; the epithelium is unmistakably spreading round a "foreign" cell, and a still earlier stage is shown in fig. 57, where a few migratory epithelial cells are just forming the "nucleus," as it were, of a wall of epithelium around two clasmatocytes (in the middle of the field), one of which already has a dense pycnotic nucleus. Lastly, included epithelial cells, so far as I have seen, still look quite like cells, with recognizable nucleus. I have seen no transitions between such and the granular, broken-down appearance of the altered plasma-cells. Of course, this is only surmise, but I should not be at all surprised if the epithelial cells are *not* able to completely break down and digest their own type of cell; I think it is quite likely that such are eventually passed out as colostrum "corpuscles." I would here refer readers to a section in my cancer paper, where I pointed out the inability of certain amoebæ to digest their own species; and the apparent corresponding inability of cancer-cells to digest other cancer-cell individuals which they may have engulfed, although they readily digest other types of cell (e.g., leucocytes).

The Later Stages of Colostrum-Formation; Inter- and Intracellular Passage of the Hamoglobin.—Up to now I have been considering the condition of the gland at a period of from ten to seven days, approximately, before birth. I pass next to the stage only one or two days before birth was expected. Now the gland is fully developed, with fully formed, large acini, whose lumina contain large and increasing masses of colostrum. To understand the appearances now shown, the condition which I found to be present in the thyroid is of great assistance, being, in my opinion, *entirely comparable*. If I may ask readers to refer to that paper [8], it will be seen that, during the stage of active colloid formation, there is a regular

passage of red corpuscles through and between the epithelial wall of the acinus, either singly or in twos and threes, or in numbers, by diapedesis on a large scale (cf. my figs. 6 to 8, l.c.). I dealt there with the characteristic pale hæmoglobin-"vacuoles," which gradually reacquired affinity for stains, becoming pink again as they pass into the colloid already formed.

An exactly similar process is now occurring on a comprehensive scale in these alveoli of the mammary gland, the altered corpuscles, as they penetrate into the lumen, becoming transformed into colostrum and adding to the quantity already present. This process is illustrated in figs. 58 to 63. The normal red corpuscles (*r.c.*) are, as usual, red or black, or red with some black still remaining in. Corpuscles in an early stage of metabolism are pink (*p.p.c.*), some being pale, others becoming a stronger pink; the latter represent early colostrum, in just the same way that I found early colloid was also indicated by pink-staining corpuscular material (cf. especially my fig. 8, l.c.). These "vacuoles" containing altered corpuscles are seen in the cytoplasm either on the outer or on the inner side of the cells, according to how far the passage through them has progressed (cf. figs. 58 to 61). Moreover, just as many of the corpuscles appear narrow and elongated (cf. the reference *r.c.* on the right-hand side of both figs. 58 and 59), so equally do many of the hæmoglobin-"vacuoles" (cf. the upper reference, *p.p.c.*, fig. 60 and the same reference, fig. 61). This is a most significant point, I think, as showing definitely that we have to do with "solid" corpuscular material; and here again, no tiny "droplets" are seen—nothing smaller than a red corpuscle! This is exactly as I found to be the case in connexion with the smallest masses of separate colloid formed:

In figs. 62 and 63 such hæmoglobin-"vacuoles" are seen passing into and mingling with the colostrum already present—in the same manner as the newly-formed colloid was added to the existing quantity in the lumen (cf. my fig. 14, l.c.). At first these additional little portions are still a lighter pink (varying in tint), and are also homogeneous in appearance; but they gradually become darker and more granular until they agree with the general character of the colostrum. At this stage the fully-formed colostrum tends to retain the iron-hæmatoxylin strongly, the larger granules especially staining an intense black. I think this is due to the great quantity of iron present at this stage (cf. fig. 43); and the same condition is present in the colloid.

(3) THE EARLY STAGES IN THE FORMATION OF MILK.

The Transformation of the Colostrum into Milk-Fat.—When lactation is about to commence, the alveoli present a very different picture. The epithelium is flattened and extended; there is no sign of "secretion" or of diapedesis of corpuscular material. The lumina are bulging with colostrum, and this substance formed, as we have seen, from hæmetaboly,

and to a certain extent also from digested cells (*cytometaboly*), is now becoming transformed into some of the constituents, at any rate, of milk. At this stage the milk-fat is produced directly by the further alteration of this colostrum, i.e., from the protein material of the hæmoglobin, etc. I think this will be perfectly clear from figs. 64 and 65. The former shows a field of a section of material fixed with Flemming's fluid and stained only with eosin (rather lightly), so that there should be no possibility of the fat being mistaken in the reproduction. This is seen browned or blackened by the osmic, and appears in the form of spherules of varying size from very minute ones upwards. They develop *in situ* in the colostrum material; the appearance is entirely different from that above described in connexion with the hæmoglobin-"vacuoles." Further, at this stage, there is no indication of the formation of the fat in the cells themselves by direct secretion, and it is important to bear this point in mind. Here and there a fat globule is seen in contact with the epithelium, lying apparently either over or under it—but that is only what might be expected where the wall of an alveolus is cut tangentially. Figs. 65 and 66 are from similar material, but the sections were stained with iron-hæmatoxylin, followed by eosin. The former was taken from the central part of the section; and in this case the osmic had not penetrated sufficiently to blacken the fat and render it insoluble. Hence, numerous vacuoles in the colostrum of all sizes represent the places occupied by the fat-droplets which have been dissolved in the course of preparing the section. There is still more or less colostrum remaining in each alveolus not yet transformed into fat. Fig. 66 shows a portion of the same section nearer the periphery, about at the edge of the zone of penetration of the osmic, and the blackened spherules are seen at the right-hand side. The few small or minute dense black granules are fine colostrum particles still retaining the hæmatoxylin. (These are not, unfortunately, well shown in the reproduction.)

Now, during actual lactation, when this first formed milk has passed out of the lumina, how is a fresh supply produced; and produced, moreover, in such quantity and with such rapidity as is manifestly the case? As I said in my introductory remarks, unfortunately I have not been able to study this period at all fully and can only give a few indications. To meet the required acceleration of production, two modifications in the above described, relatively leisurely, course of the hæmetaboly are seen. In the first, observed in material taken a day or so after birth, the appearances shown strongly suggest that the corpuscular material is forced through the cells *en masse*, probably as a result of greatly increased vascular pressure at recurring periods. In this case, *unlike* what is found when marked diapedesis through the thyroid epithelium is occurring, the corpuscles do not pass through the wall as such, i.e., separately and in an almost unaltered condition (cf. fig. 6, l.c.). The hæmoglobin in aggregated masses is rapidly transformed into colostrum-material, and it is in this guise, rather, that the altered hæmoglobin passes through or between the cells.

Different stages in the process are illustrated in figs. 67 to 71. The intensely black-staining substance is either more or less homogeneous or else in a finely granular condition. It is present in masses of varying size, either on the outer side of the cells (fig. 67, *i*); or in the act of passing through the wall, in which condition the masses often have the form of narrow, rather elongated blocks (fig. 67, *ii* and fig. 68, at the right); or lastly, spreading out again, in a characteristic crescentic manner, as it gains the lumen (fig. 68, *iii*). I think, for the most part, the passage of this material is really intercellular. But it is noteworthy that the nucleus (*N.*) generally lies very close to this substance, being, indeed, often partially hidden by it. I think this proximity is in order to facilitate and render most effective the action of the nuclear ferment (cf. the close proximity of the food-containing digestive vacuoles to the nucleus, as they circle round in the cytoplasm of an Infusorian, for instance). These blocks or masses have no actual connexion with or derivation from the nucleus, however, which appears in a very quiescent and innocent-looking condition, as I have always noted it to be, when there was reason to think metabolic activity was pronounced. Many of the reference letters *N* in the figures show this proximity of the nucleus to this black substance. Further, figs. 70 and 71, from sections stained by the Ehrlich-Biondi-Heidenhain method, also bring out this point well. This material, as also the colostrum in the lumen, appears strong red with the fuchsin, whereas the nuclei are green to purplish green in tint; fig. 70 was taken with a green screen; fig. 71, on the other hand, with a red screen, which brings out the nuclei sharply and tends to cut off the strong red of the colostrum-material.

Frequently, little crescentic masses of this homogeneous substance are seen in the lumen (at *x*, figs. 67, 70), which will add to the colostrum already present and become of the same loosely granular character. Even at this stage a few of the cells have two nuclei (cf. *N*, fig. 70); and here and there one is seen being cast off into the lumen (cf. the middle of fig. 69, the short reference, *Ns.*).

I consider this hastening forwards, as it were, of the hæmetaboly is also evidenced by the "pallid hæmoglobin" phase being passed through while the corpuscles are still in the capillaries or blood-channels, in the immediate vicinity of the epithelium (cf. *p.c.*, fig. 68). In addition, pale hæmoglobin-"vacuoles" may occur in the cells also, in this case always on the outer side (*hgb. vac.*, fig. 68). This is probably in anticipation of the final stage, when the hæmetaboly can be completely performed in the cells and intracellular fat-droplets result.

As in all the other instances, this black-staining material is markedly iron-containing; this is shown by fig. 72 from a section after the application only of the above described microchemical test for iron. The appearance is entirely comparable with that shown by the preceding figures.

Lastly, there is the well-known and commonly seen phase, found during the height of functional activity, where the huge epithelial cells, often

extending far into the lumen, contain numerous fat-droplets in the cytoplasm. I have not been able to study this stage at all, but will just put the following question. In view of what I think I have shown in the foregoing account, is it too much to suggest that, here also, the milk-fat is formed, *not by a process of secretion by the cells themselves*, as generally assumed, but by the complete intracellular metabolization of the hæmoglobin absorbed from the blood-channels? Is not the process likely to be of the same fundamental nature throughout?

A General Consideration.—One or two friendly critics have pointed out to me that, if my view is correct, the extra hæmetaboly on such a scale during the course of lactation must involve a considerable increase in the production of red corpuscles by the hæmopoietic organs at this time. I do not think this is necessarily the case—at any rate, to the extent and in such a sudden manner as might at first be expected. And if there is no marked increase in production, I think this fact would be capable of explanation. As Creighton has already suggested, notably in his book “Contributions to the Physiological Theory of Tuberculosis,” and in earlier papers, it appears to me highly probable that, during the growth of the embryo, the *placental tissue itself metabolizes the blood-elements for the use of the growing fœtus*. As Creighton says (l.c., p. 76), “The maternal blood feeds the fœtus It is a kind of metabolism of the substance of maternal blood to become a constituent of fœtal blood.” That is a subject I should much like to have studied myself, had things been different; as it is, I can only indicate the point. I know Creighton made a great mistake in minimizing the essential part played by the bacillus, in his study of tuberculosis. But, I say again, because a man makes an error or two, that is no reason why *all* his earnest, thoughtful work, over many years, should be neglected as not worth considering or following up. There is a saying that a man who never makes mistakes never makes anything! And I am not thinking only of Creighton in this connexion. To me, personally, much of Creighton’s work has been inspiring; and I firmly believe the time will come when this great new truth of the occurrence of hæmetaboly on the part of different types of tissue-cell, for the performance of various specific functions, which has been enunciated by Creighton and myself, will be a commonplace of medical teaching.

. . . Thus, at the time of birth of the fœtus, there is a “surplus” of blood no longer being utilized in the above manner; and it is this surplus, I would consider, which is then made use of in the function of lactation. Hence, as between the periods of gestation and lactation, there may not be much difference noticeable in the production-rate of the blood-elements. Now, going further back, there is still the same question to be answered. Is there an increase as between periods of gestation and non-gestation? I am inclined to think that in this case there will be a distinct increase in the rate, but a *gradual* one; and that its onset is anticipated, or allowed for, as it were, in a most interesting way, in the

normal production-rate in the female. When not required, i.e., in non-gestation periods, this excess (representing the early increase in amount) has, therefore, to be periodically wasted, either by elimination or resorption. In all probability this strange and apparently unnecessary waste of blood has some definite and deep-seated significance; because, otherwise, it is a mode of behaviour very unlike Nature's known methods.

CONCLUDING REMARKS.

There are one or two points I would touch upon in conclusion. Especially during the latter stages, I think certain of the products of the hæmetaboly, including some of the iron, are assimilated by the epithelial cells, leading to an increase in their size and in the amount of their chromatin, this last being evidenced by the duplication of the nucleus. But the important point is this. The main energies of the cell are at this period controlled and directed to the performance of its functional activity. And I see in the well-known—but none the less remarkable—feature of the breaking loose of portions of the cell-cytoplasm and elimination of some of the nuclear material another instance of beautiful adaptation to the incorporate obligations of the cells (cf. my paper on the thyroid [8], in which I dealt briefly with this most interesting aspect of the question, p. 26). This additional protoplasmic growth does not benefit the cells themselves as individuals, but is cut off and transformed in due course into milk-constituents!

Next, what becomes of all the iron of the hæmoglobin, cell-nuclei, etc., which we have seen is contained in the colostrum-material in the lumina of the alveoli? So far as I can estimate from the accounts of the chemical constitution of milk (e.g., Hammarsten, Sommerfeld), while there is a definite amount of iron in milk, the proportion is apparently much less than that in hæmoglobin, or even in whole blood. It would seem, therefore, that by no means all of the iron of the colostrum is passed out in the milk during lactation. I think it is quite likely that as the fat is formed the iron may enter into some other chemical combination, which is soluble, in which state much of it is *reabsorbed* by the epithelium, so as not to be lost to the body. We have an entirely comparable occurrence in the case of the liver, where the iron of the corpuscles digested (with resulting formation of bile-constituents) is retained and again utilized. As bearing on this point it may be noted that colostrum in which milk-fat is being formed does not retain the iron-hæmatoxylin nearly so strongly as material in which no fat-droplets (or vacuoles representing the same) are present (cf., for instance, fig. 65 with figs. 58-63, or with fig. 67). This is further indicated moreover by the intensity of the iron-reaction, the blue being decidedly deeper in early colostrum than in that which is being transformed into milk-fat.

Finally, there is the question of the other milk-constituents, e.g., the proteins. While the blood-plasma doubtless supplies certain of these, I

think it is quite likely that some of the proteid substances may also be formed as a result of the further metabolization of the hæmoglobin-colostrum, just as certain are known, or considered, to be produced by further alteration of broken-down cellular elements, such as leucocytes, cast-off epithelial fragments, etc., comprising the so-called colostrum-corpuscles. Manifestly, this question is one of great importance, but I am unable to say anything about it here. My whole aim in this paper has been to show the extent to which hæmetaboly is concerned in the growth and increase of the epithelium of the developing gland during the later stages of pregnancy, and in the formation of colostrum, and subsequently of milk-fat.

With the completion of this, my seventh paper dealing with the subject, I am reluctantly obliged to give up my study of hæmatophagy and hæmetaboly—at any rate for the present—because I have been unable to get adequate pecuniary support to continue.

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- [9] *Idem*. "A Modification of Dr. Charles Creighton's View of Malignant Growths," *op. cit.*, xliii, 1923, 241.

EXPLANATION OF FIGURES.

(All are reproductions of photomicrographs, which were kindly taken for me by Mr. A. Dennis.)

The following abbreviations are used throughout for reference :—

b. n.	basket-cell nucleus.	hgb.	= hæmoglobin-mass.
cap.	= capillary.	N.	= nucleus.
cl.	= clasmatocyte (or plasma cell).	n. d.	= early stage in direct nuclear division.
col.	= colostrum.	p. p. c. (or p. c.)	= pink or pale pink corpuscle (early colostrum)
conn. tiss. N.	= connective - tissue - cell nucleus.	r. c.	= red corpuscle.
endo. N.	= endothelial nucleus.	vac. (or hgb. vac.)	= pale hæmoglobin-"vacuole."
Ep.	= epithelial cell.		
ep. N.	= epithelial cell nucleus.		

(For description see text.)

FIGS. 31 to 36.—To show early stages in the formation of colostrum by inclusion or surrounding of the blood by the epithelial cells and alteration of the hæmoglobin. (S.A.A., iron-hæm. + eosin; figs. 32 to 34, $\times 450$, figs. 31, 35 and 36 $\times 600$.)

FIGS. 37 to 40.—Series to show alteration of corpuscular material into a little hæmoglobin-mass as the capillary becomes surrounded by epithelial cells. (As last; $\times 600$.)

FIGS. 41 and 42.—To show the agreement in staining appearance between the red corpuscles and colostrum, after the Ehrlich-Biondi-Heidenhain stain. (Dominici; fig. 41, the red (fuchsin stain) predominating; fig. 42, the yellow (orange stain) predominating; $\times 450$.)

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FIG. 43.—To show the intense blue reaction of the colostrum after the application of the test for iron. $\times 450$.

FIG. 44.—Thick blood-film, fixed wet (S.A.A.) and treated as last. Corpuscles blue; no blue colour in the plasma. $\times 600$.

FIGS. 45 and 46.—To show stages in the surrounding of clasmatoocytes (plasma-cells) by the epithelium and their breakdown and alteration into colostrum in the resulting lumina of the alveoli. (S.A.A., iron-hæm. + eosin; $\times 600$.)

FIGS. 47 to 55.—Series to show the formation of complete alveoli as cords of epithelial cells, which become hollow, i.e., possessing a lumen, when they contain colostrum material resulting from included and digested clasmatoocytes. (S.A.A., iron-hæm. + eosin; $\times 600$.)

FIG. 56.—Alveolus containing two included epithelial cells. (As last; $\times 600$.)

FIG. 57.—To show epithelial cells spreading and beginning to surround two clasmatoocytes i.e., the earliest stage in the formation of an alveolus. (As last; $\times 600$.)

FIGS. 58 to 61.—To show passage through the cells of corpuscular material in the form of pink or pale pink hæmoglobin-“vacuoles.” (Dominici, iron-hæm. + eosin; $\times 600$.)

FIGS. 62 and 63.—Mingling of hæmoglobin-“vacuoles” with colostrum already present in the lumen, and gradual alteration of the former into the latter. (As last; $\times 600$.)

FIGS. 64 to 66.—To show the formation of the fat-droplets from the colostrum, and their absence from the cells. (Flem.; fig. 64, eosin alone; figs. 65 and 66, iron-hæm. + eosin; $\times 600$.)

FIGS. 67 to 69.—Later stage, to show diapedesis *en masse* of corpuscular material in the form of altered hæmoglobin, through or between the cells, to form colostrum. (S. A. A., iron-hæm. + eosin; fig. 67 $\times 450$, figs. 68 and 69 $\times 600$.)

FIGS. 70 and 71.—The same, from a section stained by the E. B. H. method. (Fig 70, with a green screen, to bring out the red; fig. 71, with a red screen, to show that the nuclei are quite distinct from the colostrum-material passing through the wall. $\times 600$.)

FIG. 72.—The same, from a section treated only for the iron-reaction. The densely black (or red) staining material of the preceding figures is strong blue, as strong as, or even stronger than the colour of the nuclei, indicating a marked iron-content. ($\times 450$.)

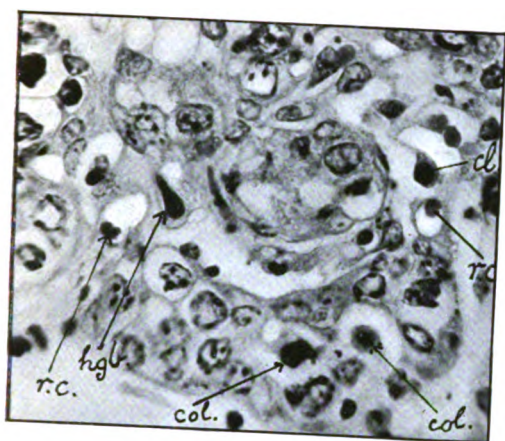


FIG. 31.

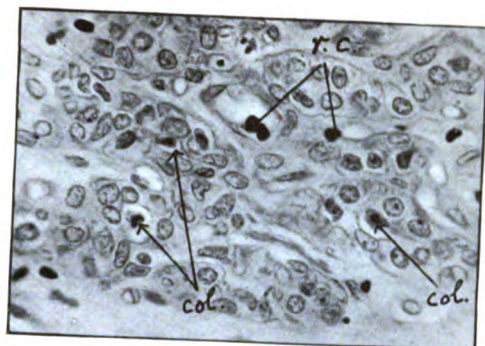


FIG. 32.

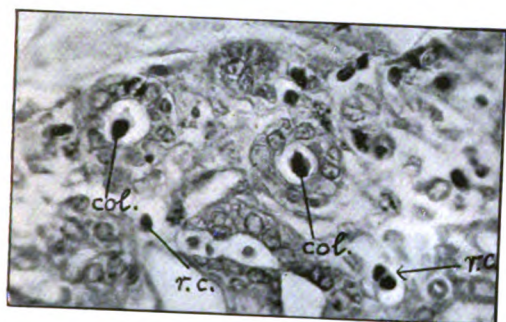


FIG. 33.

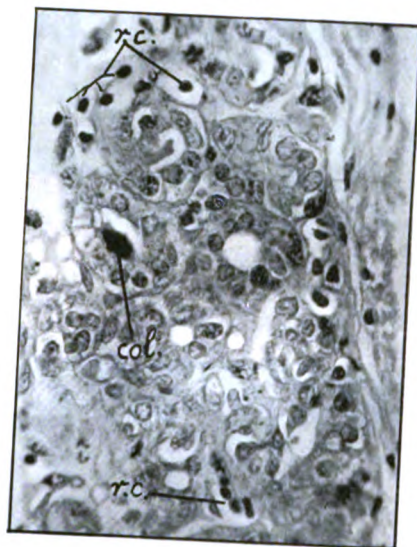


FIG. 34.

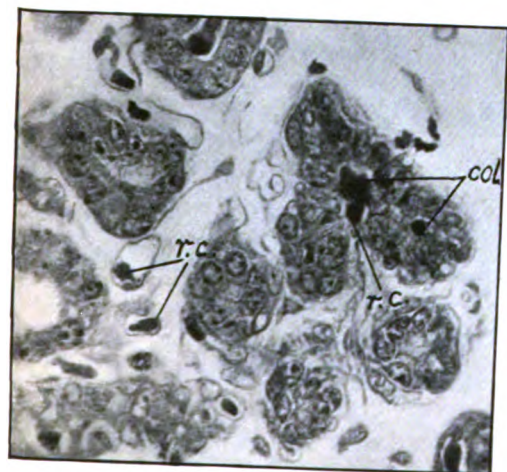


FIG. 35.

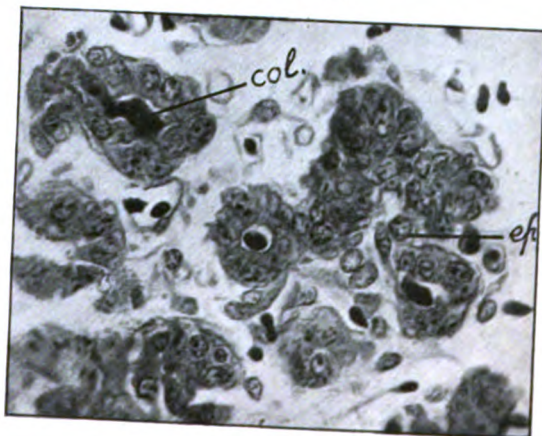


FIG. 36.

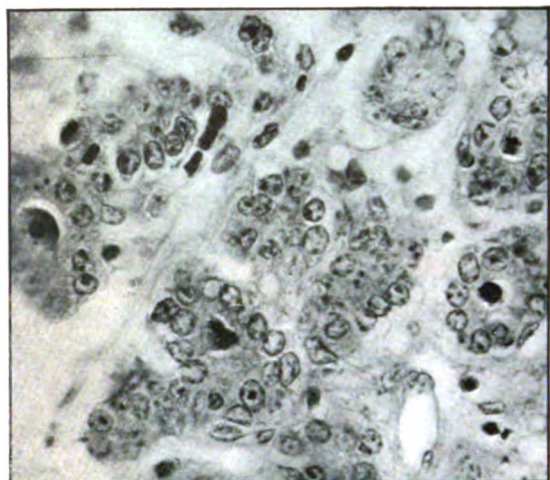


FIG. 37.

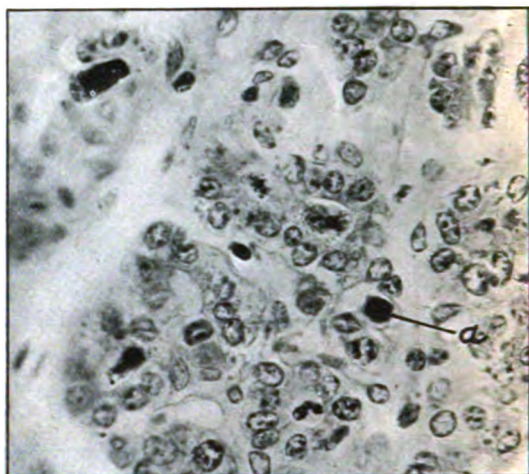


FIG. 38.

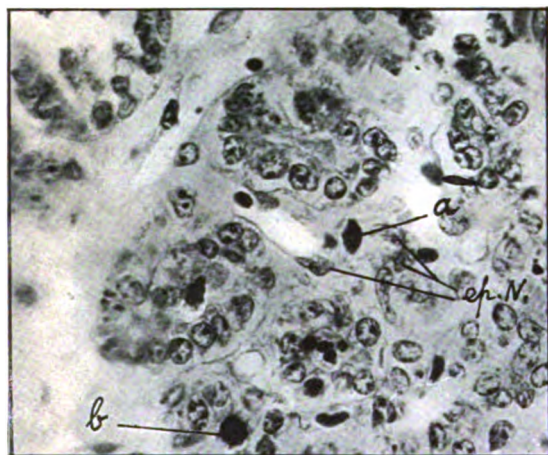


FIG. 39.

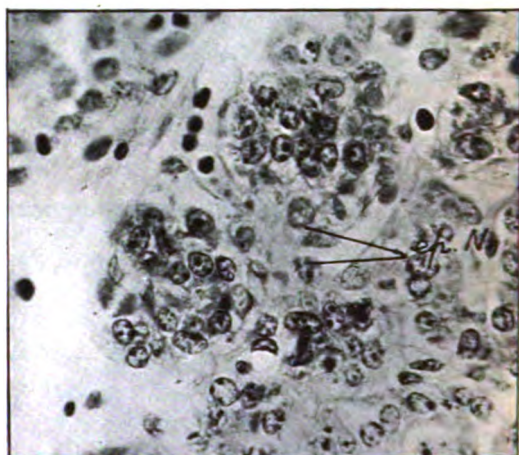


FIG. 40.

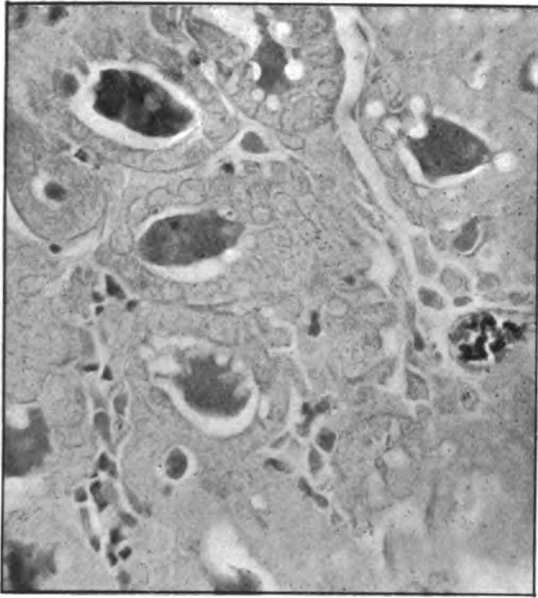


FIG. 41.

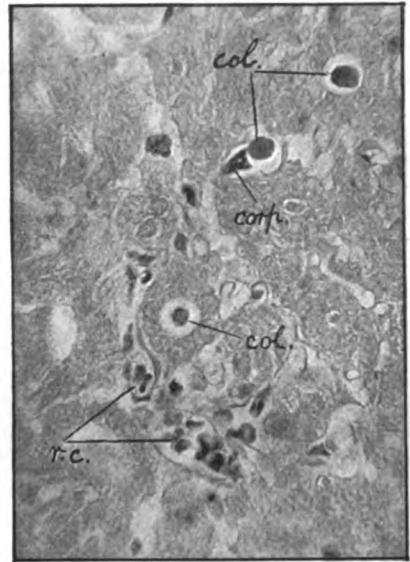


FIG 42.

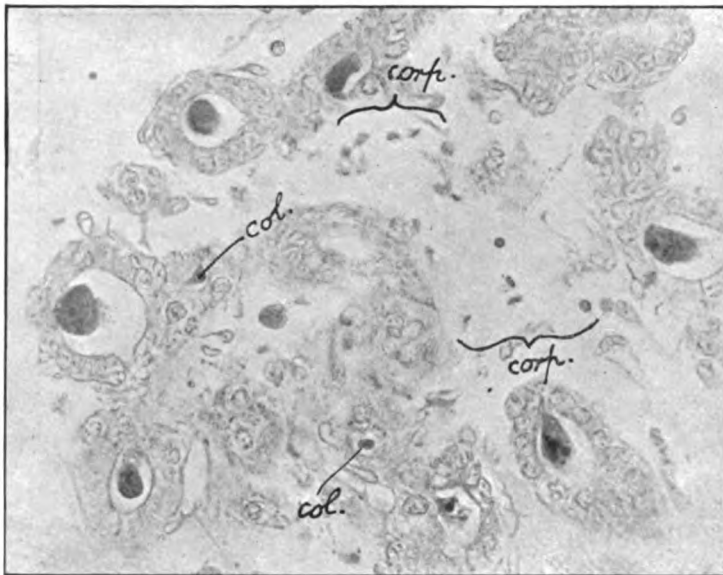


FIG. 43.

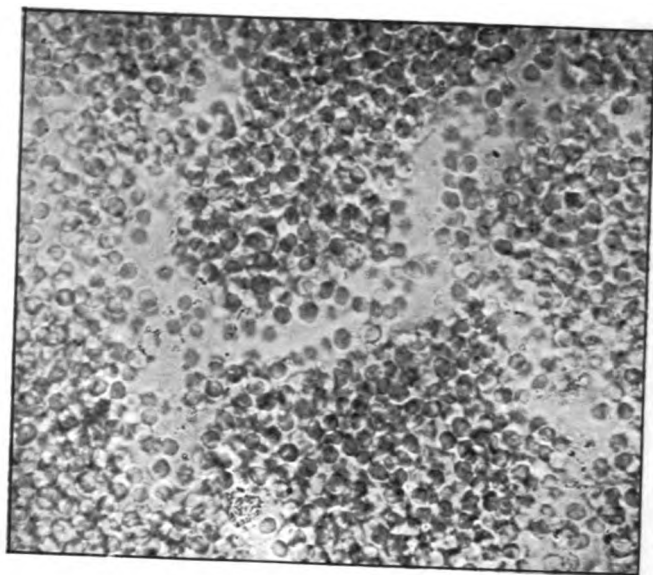


FIG. 44.

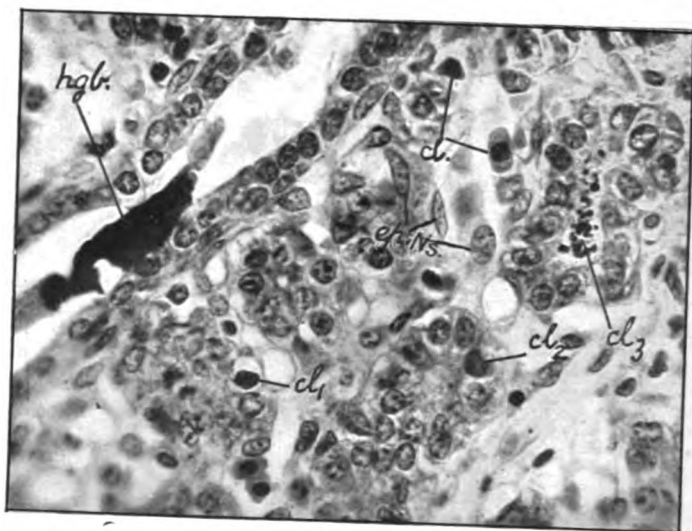


FIG. 45.

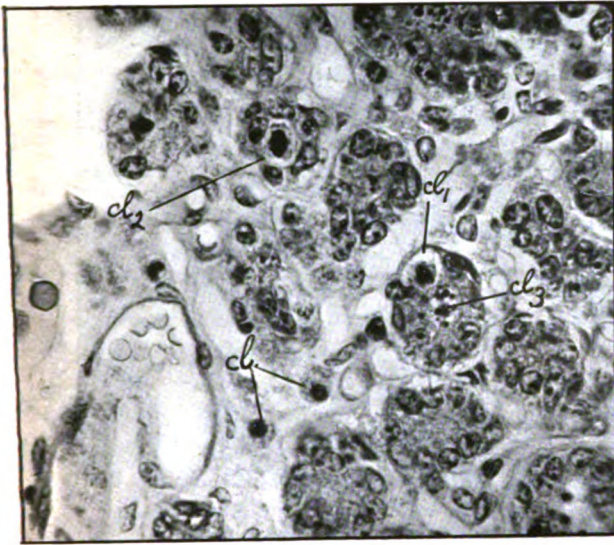


FIG. 46.

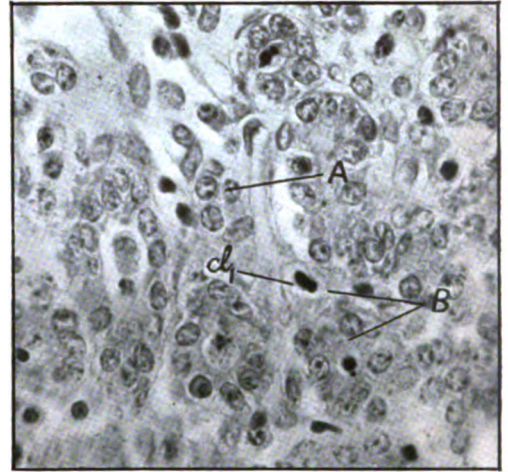


FIG. 47.

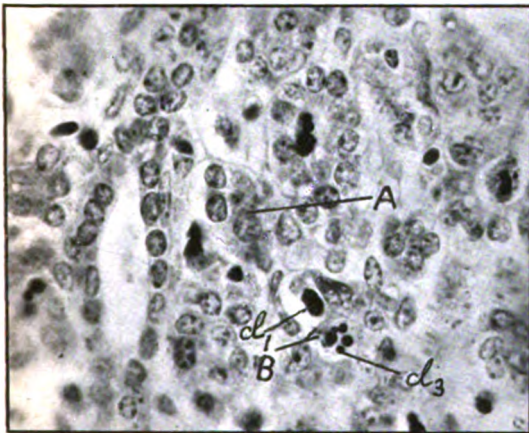


FIG. 48.

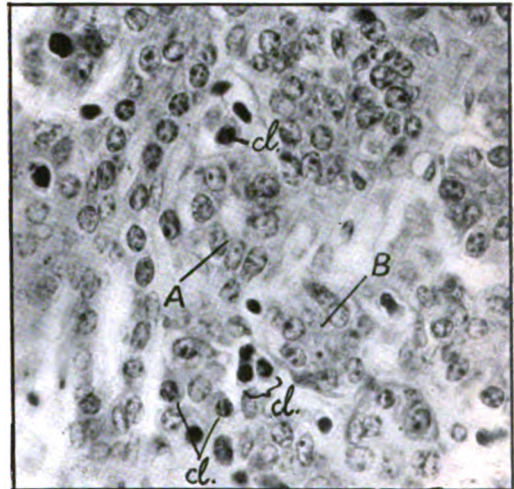


FIG. 49.

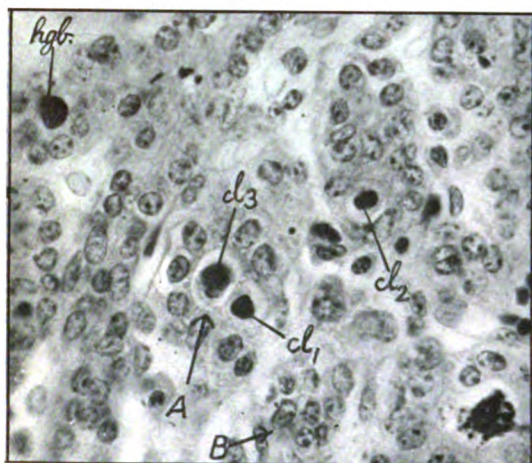


FIG. 50

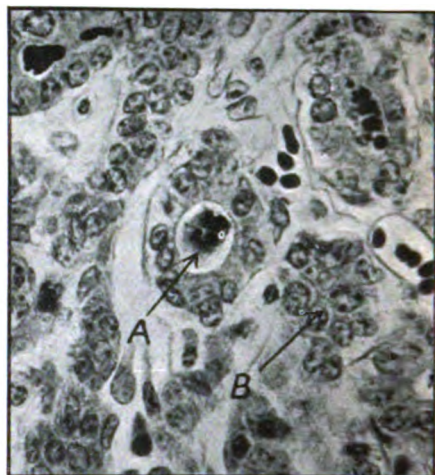


FIG. 51,

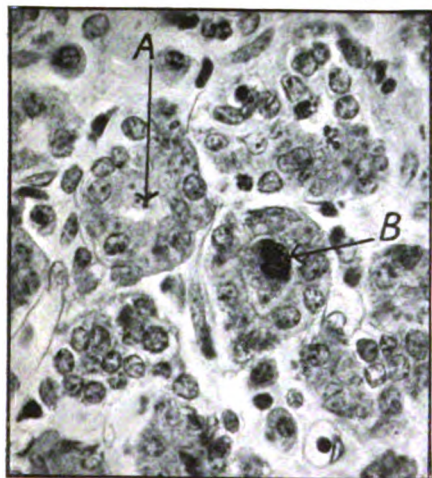


FIG. 52.

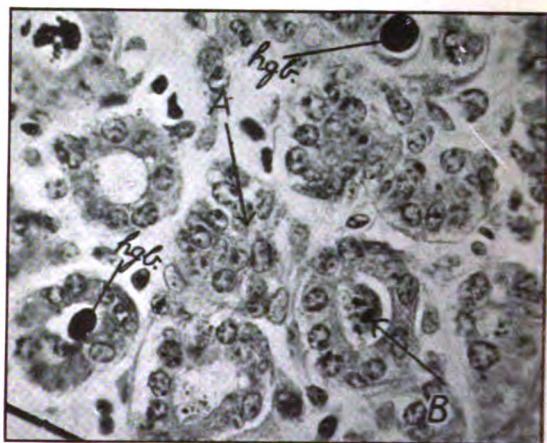


FIG. 53.

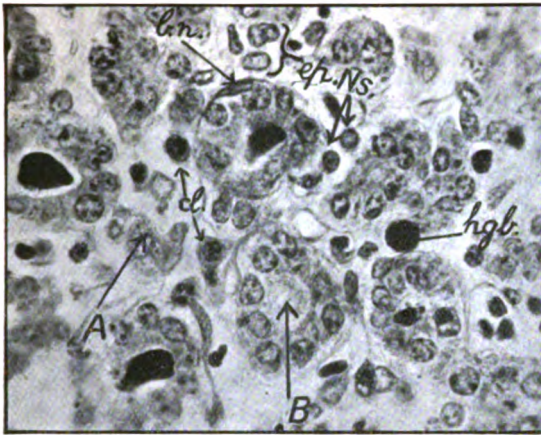


FIG. 54.

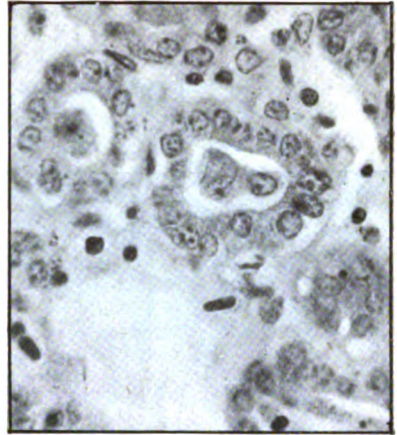


FIG. 56.

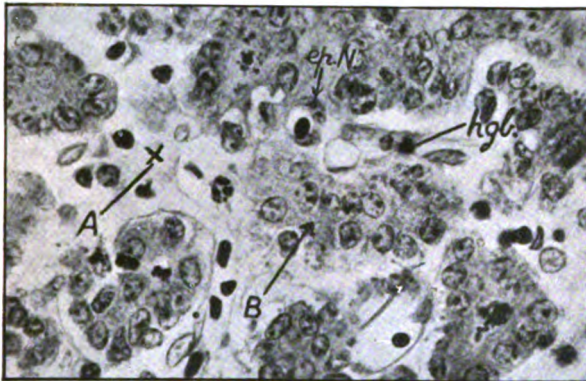


FIG. 55.

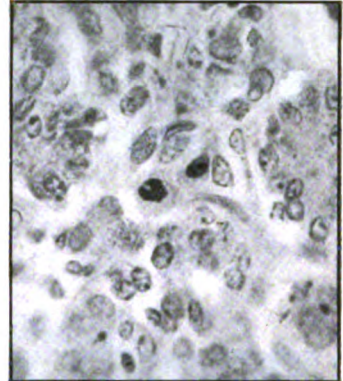


FIG. 57.

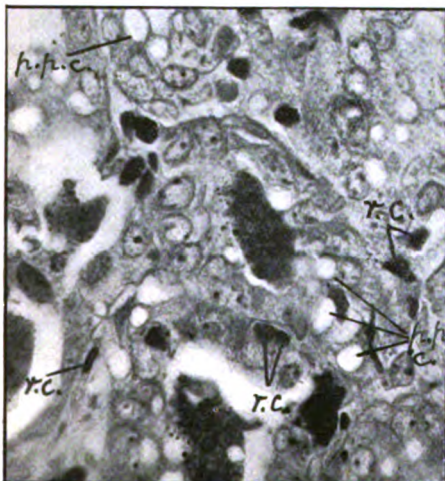


FIG. 58.

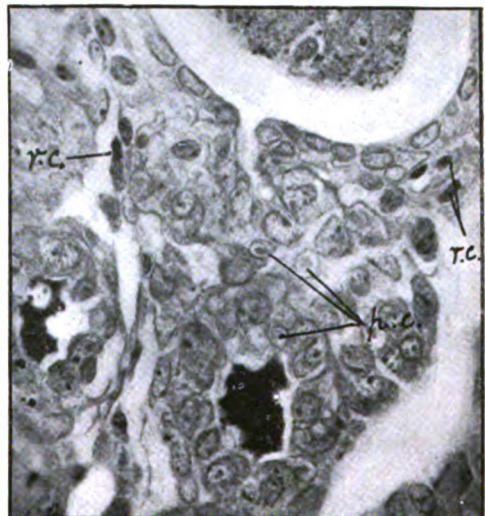


FIG. 59.

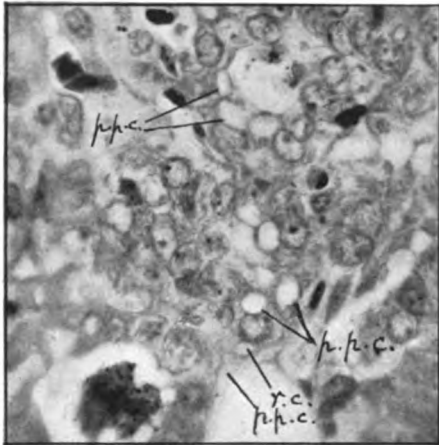


FIG. 60.

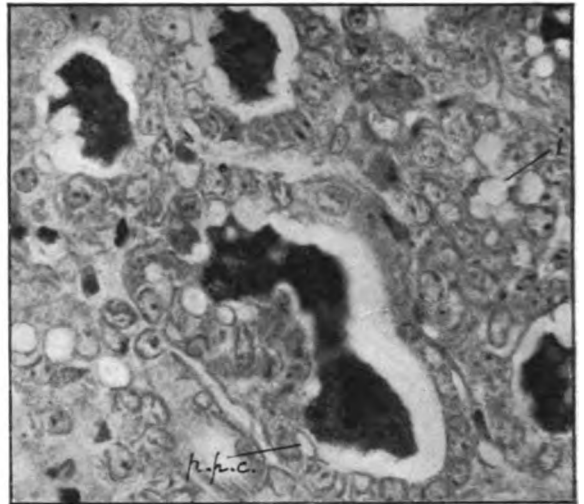


FIG. 61

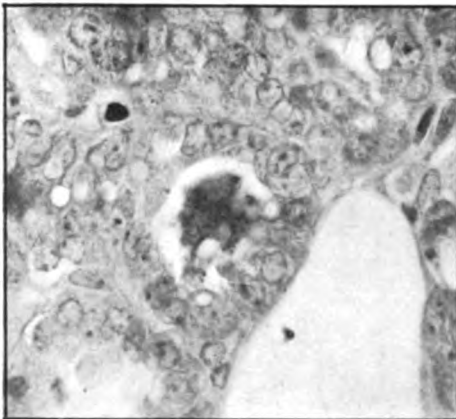


FIG. 62.

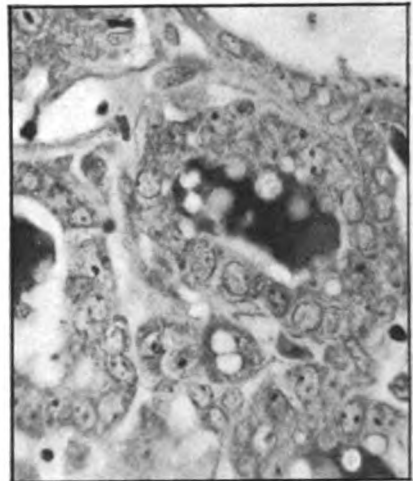


FIG. 63.

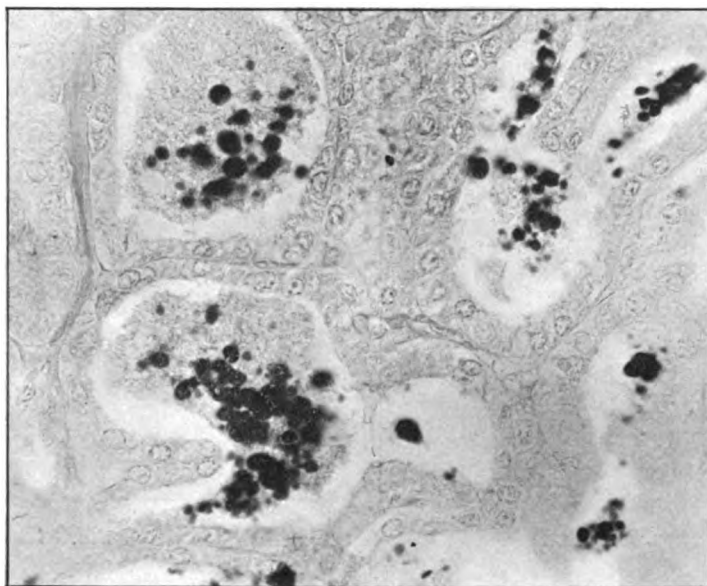


FIG. 64.

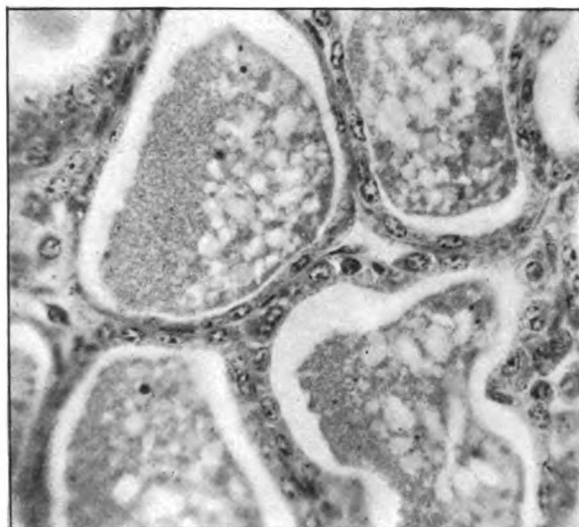


FIG. 65.

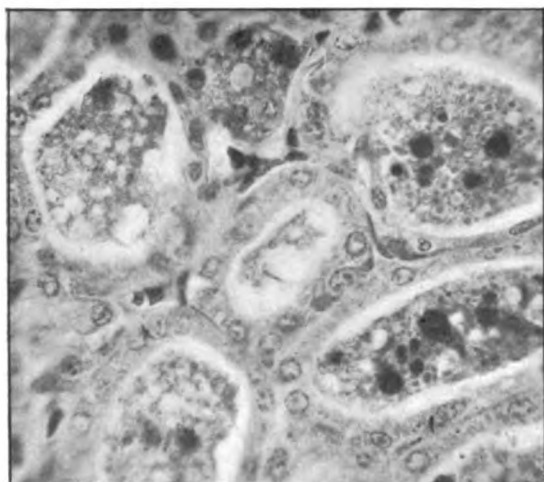


FIG. 66.

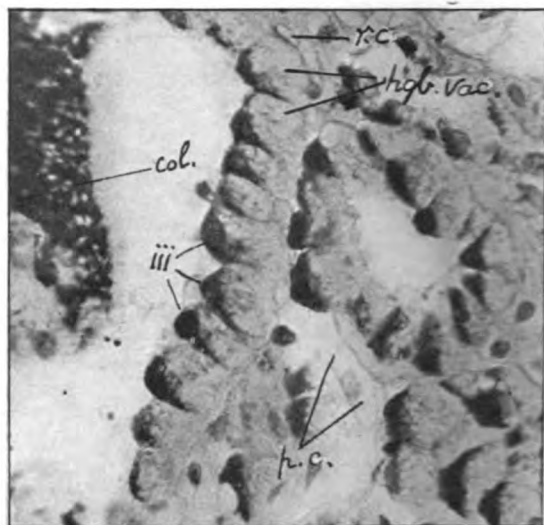


FIG. 68

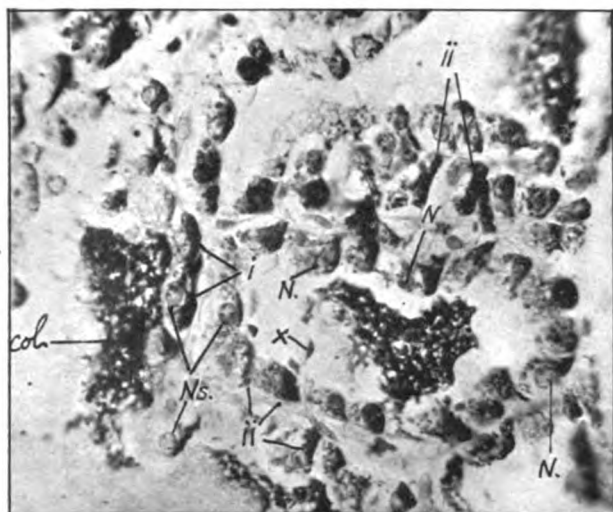


FIG. 67.

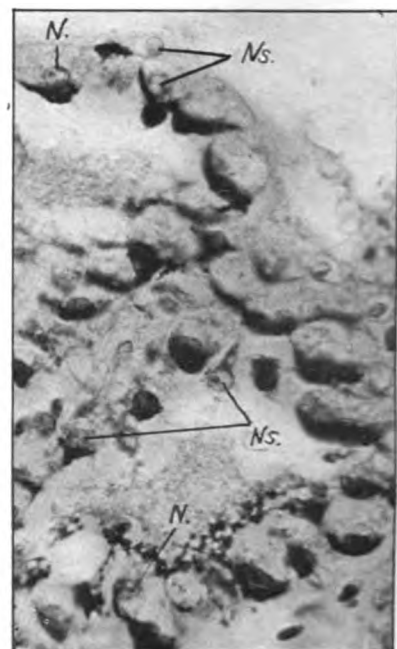


FIG. 69.

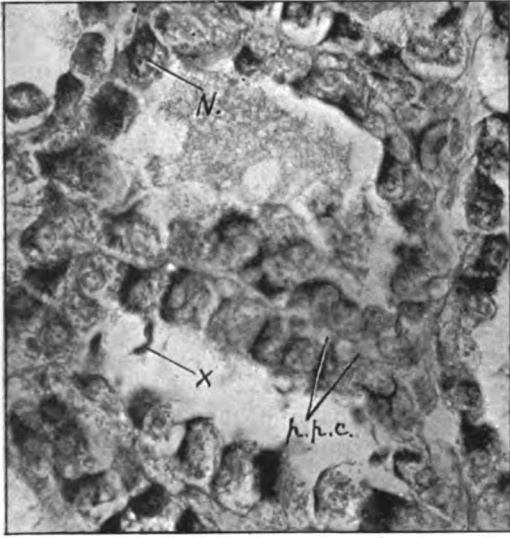


FIG. 70.

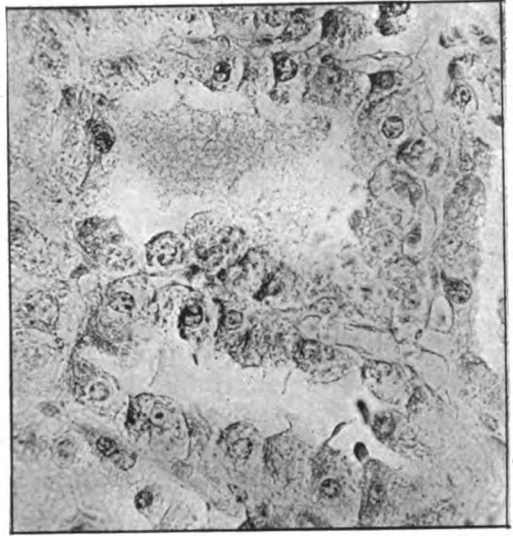


FIG. 71.

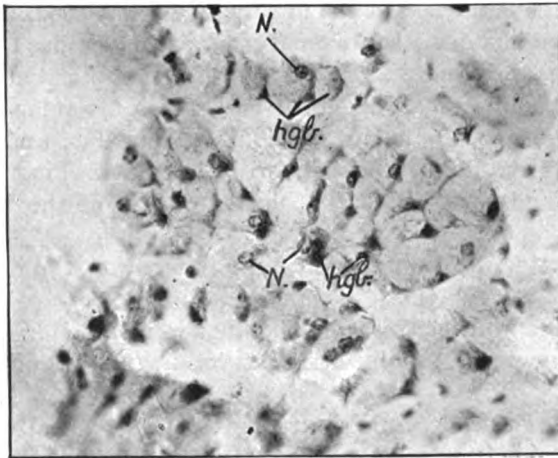


FIG. 72.

SOME OF THE COMMONER INJURIES OF THE KNEE-JOINT.¹

By MAJOR A. H. HESLOP, D.S.O., O.B.E., F.R.C.S.ENG.
Royal Army Medical Corps.

ALL the injuries described can be classified as sports injuries, and all come under the care of the general practitioner in his daily work.

ANATOMY.

In treating injuries of the knee-joint it is most essential to have a good knowledge of the anatomy of the joint. I propose therefore to deal briefly with the most important anatomical points which are concerned in the injuries under discussion. The knee-joint is a hinge-joint which owes its strength to powerful ligaments and especially to muscles and fasciæ which surround it. It derives no strength from the shape of the articular surfaces of the femur and tibia. The most important ligaments are the ligamentum patellæ which through the patella gives the attachment of the quadriceps muscle to the tubercle of the tibia; the two comparatively weak lateral ligaments which are tense in extension and lax in flexion of the joint; the two crucial ligaments, which are very powerful and are more or less tense in all positions of the joint. The anterior crucial ligament resists extension and forward displacement of the tibia, while the posterior resists flexion and backward displacement of the same bone. Both ligaments check internal rotation of the tibia. The most important factor in maintaining the efficiency of the knee-joint is that the muscles surrounding the joint should be in a state of good tone. This applies especially to the quadriceps extensor muscle. The knee-joint is complicated by having the two semilunar cartilages attached to the upper articular surface of the tibia, by the presence of the infrapatellar pad of fat, and by numerous synovial fringes. An important point to be emphasized is that the internal semilunar cartilage is attached to the deep fibres of the internal lateral ligament.

The movements are flexion, extension and rotation, the latter movement being only possible when the joint is flexed.

The commoner injuries to which the knee-joint is liable are :—

(1) Simple sprain of the internal lateral ligament; commonly called "sprain of knee."

(2) Slipping of the semilunar cartilage, more especially the internal, and popularly termed "putting out the knee."

(3) Nipping of the infrapatellar pad of fat. All these injuries may be produced by a twist or fall; all are associated with effusion of fluid into the joint, and in all the patient complains of more or less recurring dis-

¹ A paper read before the Hyderabad, Deccan, Branch of the British Medical Association.

ability after the lesion unless it has been early recognized and efficiently treated. Every case of recurring synovitis has a cause, and each is curable if the cause is recognized and receives proper treatment.

We will now discuss the mechanism of these injuries. The internal semilunar cartilage is closely connected round its convex margin with the deepest fibres of the internal lateral ligament. A severe twist of the knee with the leg abducted and the foot everted stretches this ligament producing sprain of the knee, or it may rupture the ligament which drags the semilunar cartilage with it, straining or tearing its anterior attachment. At this stage the inner side of the joint is opened and the resultant injury depends on what happens when it closes. If the cartilage is caught in the displacement between the bones the knee locks and we have the most important symptom of a dislocated semilunar cartilage. But often the cartilage slips back into position without being crushed or caught, and although the ætiology of the lesion is the same, the patient can easily straighten the knee after the accident. Unless this last mentioned condition is efficiently treated the patient will complain of an occasional "give" in the knee which, with a slight unusual twist, may result in real locking of the joint.

In addition to twisting injuries of the knee-joint a split semilunar cartilage may be readily produced by violent blows on the joint.

Any injury may cause increased vascularity of the infrapatellar pad of fat. As the fat swells it pushes its way into the joint and is liable to be nipped in full extension.

Let us now briefly discuss the signs and symptoms of these injuries:—

(1) *Sprain of the Internal Lateral Ligament.*

There is a history of a twist of the knee, with the knee flexed and foot everted. The patient complains of pain and tenderness over the internal lateral ligament. Pain is localized to the inner side of the knee and no pain or tenderness is found elsewhere. Eversion and external rotation of the leg stretch the ligament and cause pain. Fluid is present.

(2) *Slipping of the Internal Semilunar Cartilage.*

Again there is a history of a twist with the fixed knee and everted foot, but the twist is more severe. Acute sickening pain is felt at the time of the accident. In addition to the symptoms complained of in sprain of the internal lateral ligament there is a history of something slipping in the knee or of the knee locking. Pain and tenderness are felt to the inner side of the ligamentum patellæ at the anterior attachment of the cartilage.

(3) *Nipping of the Infrapatellar Pad of Fat.*

Here we have pain and tenderness in front of the knee with slight fulness at the sides of the ligamentum patellæ. Flexion is painless but passive extension causes pain. There is often recurrent effusion into the joint.

Diagnosis.—In making a diagnosis of injuries of the knee-joint it is most important that a systematic system of examination of the joint should be carried out. As the same system should always be followed mention will have to be made of some of the rarer injuries to which the knee-joint is liable, and which will not be discussed in this paper. Every case of injury to the knee-joint should be submitted to radiological examination. A radiogram will demonstrate osteo-arthritis of the joint, fracture of the spine of the tibia, fracture of the patella, the presence of bony, loose bodies, foreign bodies, the tearing off of the bony attachment of ligaments, or the presence of Schlatter's disease, which, you will remember, is epiphysitis of the tubercle of the tibia, when this tubercle is developed from a separate centre.

Examination of the Joint.—Examine the joint and note the presence of fluid; note the presence of tenderness over the internal or external lateral ligaments indicating sprain of these ligaments. Note if there is tenderness on either side of the ligamentum patellæ at the anterior attachment of the semilunar cartilages. Tenderness in either of these situations shows injury to the cartilages. Pain over the internal lateral ligament on abduction of the leg indicates sprain or rupture of that ligament, while pain over the external ligament on adduction of the leg shows a similar injury. Tenderness on both sides of the ligamentum patellæ, with fullness in this region, indicates swelling of the infrapatellar pad of fat. Limitation of flexion or extension of the joint may be due to locking or to the presence of a large amount of fluid. Pain on passive extension is due to nipping of the infrapatellar pad of fat. Displacement forward of the fully extended leg indicates rupture of the anterior crucial ligament, while displacement backwards of the fully flexed limb indicates a similar injury of the posterior crucial ligament.

Treatment of these injuries:—

(1) *Sprain of the Internal Lateral Ligament.*—The treatment consists of rest in bed with the leg immobilized on a back splint, for fourteen days. This is to enable the injured ligament to return to normal. Evaporating lotion may be applied for a few days and then the joint and muscles should be massaged. At the end of fourteen days if the synovitis has subsided allow the patient up with the knee firmly strapped, and to prevent undue strain on the ligament throw the weight on the outer side of the foot by raising the inner side of the sole of the boot half an inch.

The muscles should be treated as described later.

(2) (I) *Displacement of the Semilunar Cartilage without Locking.*—The treatment for this condition is identically the same as that for sprain of the internal lateral ligament.

(II) *Displacement of the Semilunar Cartilage with Locking.*—Complete reduction of the locking is absolutely essential. This is best done without an anæsthetic. With the patient on his back, the leg flexed on the thigh, and the thigh flexed on the abdomen, tell him to "kick." On the word

"kick" rapidly rotate the foot inwards and pull, when reduction is usually effected. In a nervous patient an anæsthetic will be necessary. If reduction is successful full extension of the limb will be obtained. The joint is then firmly bandaged and treated as a sprained internal lateral ligament. A case so treated will not give any further trouble.

When locking of the joint becomes recurrent the cartilage must be removed.

(3) *Nipping of the Infrapatellar Pad of Fat*.—Our aim here is to prevent further nipping. Rest in bed in a back splint is essential to enable the fluid to subside and the swollen pad to return to normal. To prevent further nipping, extension of the joint must be limited. This can easily be done by putting a cork pad, half an inch thick, inside the boot under the heel. When this is ineffective a special cage appliance must be worn which limits extension by 30°. As the subcrureus muscle is attached to the pad of fat, treatment of the quadriceps muscle must be carried out to improve its tone.

When discussing the anatomy of the knee joint you will remember that I said that the integrity of the joint depends very largely on the condition of the muscles and especially of the quadriceps extensor muscle. This muscle atrophies very readily in injuries of the joint, and unless it is brought back to its original condition recurrent synovitis results, making the joint weaker and more liable to reproduction of any of the previously mentioned injuries. In fact much of the success obtained in these cases depends on the ability to get the muscles back to their normal state.

There are two methods of maintaining good muscle tone and in preventing atrophy. The first is by means of faradization and is called by Bristow gradual contraction of the quadriceps, or G.C. quadriceps. A Bristow's coil is the best type for use, the strength of the current being regulated by withdrawing and pushing in the secondary coil. Excellent results have been obtained by Bristow, who even uses it to maintain muscle tone in tubercular lesions. The second method is by means of a simple procedure. Hold the leg below the fully extended knee, and tell the patient to pull up his knee cap without bending the joint. A good contraction of the quadriceps muscle will be obtained. If this simple exercise is performed 100 times daily you will be surprised at the excellent results obtained.

In conclusion, I would like to emphasize the importance of not being satisfied with a diagnosis of synovitis of the knee. Synovitis is after all only a symptom which occurs in many conditions. The cause must be found to enable efficient treatment to be carried out. If this is not done a chronically weak knee may be the result.

Clinical and other Notes.

TWO CASES OF ACTINOMYCOSIS.

BY LIEUTENANT-COLONEL J. DORGAN.
Royal Army Medical Corps.

Two soldiers recently developed actinomycosis of the jaw whilst serving on the Rhine. The history and clinical features definitely indicate that the disease had been contracted in England or Scotland. Shortly before their arrival in Germany both men had been admitted to hospitals at home with inflammatory conditions of the jaw, which resulted from injury to the local mucous membrane.

The first man was in hospital in Cologne for over six weeks before the cause was suspected, during which time the disease progressed rapidly, and the patient became dangerously ill. After the diagnosis was made and treatment by potassium iodide adopted, a very definite improvement resulted. The cause of the condition was early suspected in the second patient, and in his case the progress of the disease was arrested before the tissues were seriously implicated.

Case 1.—Private J. B., 1st Battalion The West Yorkshire Regiment, enlisted at York, January 27, 1923. He was a tailor by trade. He was a patient in the Military Hospital, York, suffering from a cellulitis of the left side of the neck from June 29 to July 11, 1923. The swelling apparently subsided before his discharge from hospital. On or about July 21 a septic tooth was extracted from left lower jaw.

On August 1 he arrived with a draft in Germany. He was in camp and on manoeuvres from end of August to September 20, when he was admitted to No. 36 Casualty Clearing Station with a chronic hard swelling beneath the left jaw. He states he noticed the swelling and stiffness of the jaw since about September 1. On September 24 the swelling was opened, and a sinus probe was passed in many directions. The medical officer who saw the case considered that the infection had been introduced not later than August 1, as there was already considerable tissue destruction and fibrosis when the abscess was opened. The patient subsequently had several operations around the face, neck, and tongue. The disease was not definitely diagnosed until October 27, when specimens were submitted to microscopical examination. He was then given potassium iodide in increasing doses up to 120 grains thrice daily. He was for some time on the D.I. and S.I. Lists, but eventually he progressed favourably under local dressings of bismuth, iodine, and paraffin. He was discharged cured on January 29, 1924. Some thickening and stiffness of the jaw remained.

This patient does not remember eating grain or grasses. He often ate

raw onions in England and also raw lettuce and tomatoes in Germany. He had had no connection with cattle or horses.

Case 2.—Trooper T. G., 1st King's Dragoon Guards, enlisted as a band boy in this regiment in 1918. His duties were mostly in the band, but he at times groomed and fed horses. In June, 1923, he broke his right jaw by falling from his horse, and was in hospital at Edinburgh for three weeks. His medical history sheet is not available. He returned to duty after three weeks in hospital, and states that he was readmitted a fortnight later, a swelling having developed near the site of fracture. A septic tooth was extracted in hospital at this time. He was discharged from hospital a week before he left for Cologne, where he arrived with his regiment on October 11, 1923.

This patient was admitted to No. 36 Casualty Clearing Station, Cologne, on October 20, with a discharging sinus near the angle of right jaw. On X-ray examination a tooth was found embedded beneath the gum; it was removed under an anæsthetic. The discharge, however, continued, and on November 12 was found to contain *Streptothrix actinomyces*. Abscesses were freely opened, and potassium iodide was given internally, with good result. He had the habit of chewing corn and straw in stables.

The following preventive measures were taken :—

Both men were isolated, dressings and discharges were burned, separate feeding utensils were supplied for their sole use.

Printed notices have since been posted in all horse lines warning troops against the dangerous habit of chewing hay, straw, and corn. Men are similarly warned after teeth extraction, and in mounted units they are excused stables for a week.

The lesson from these cases points to the advisability of disinfection after teeth extraction or other injury to the jaw, especially in men connected with stables, fodder, and grain, and also to the early investigation bacteriologically of inflammatory tumours of the jaw occurring in connection with wounds or abrasions of the mucous membranes of the mouth.

Both patients were seen six months after discharge from hospital. There were no ill-effects other than the extensive scarring. The jaws were freely movable.

The statistical figures for Germany for actinomycosis and botriomycosis in cattle, show the following averages per thousand for the year 1917 :—

Horses		Cows		Calves		Pigs		Sheep
0·16	...	3·97	...	0·03	...	0·27	...	0·01

The Director of the Slaughter House in Cologne states that cows are infected with localized actinomycosis on an average of 4 per 1,000. The infection being mostly in the lower jaw and tongue, and sometimes on the udder.

The local population, however, does not appear to suffer much from the disease. Four deaths have been notified in the past ten years as due to actinomycosis in Cologne City. In the rural districts the disease is more frequently noted.

Travel.

ON A PERSIAN HIGHWAY.

By CAPTAIN J. C. BURNS.

Royal Army Medical Corps.

I.

RAILHEAD at Quairaitu on the Persian border was like any other of the railheads of the various military systems in Mesopotamia. A barbed wire fence enclosing the army canteen, a supply dump, a field post office with babu and mail bags, several rows of dusty, badly pitched E. P. tents for the various oddments of railway personnel, and of course the inevitable Armenian restaurant. Over all this put a blistering sun and the picture of stale monotony and dreariness is complete.

It was not till 9 a.m. that the train with much clanging and banging came to a halt, and the weary engine had ceased to wheeze and splutter after its long and obviously exhausting journey from Baghdad to the edge of the Persian plateau. It was mid-August and on leaving the relatively cool darkened carriage the heat seemed to hit one a blow in the face, while the landscape rocked before the eyes half blinded by the glare. Quairaitu is closely surrounded by ranges of hills of stark naked rock which reflects the summer sun till the huddle of tents in the hollow sizzle in the oven-like heat. The journey from Baghdad had been got through during the cool hours of the night. It was 7 p.m. when we left Baghdad East, thus the depressing view of the monotonous tawny waste which stretches from the city walls to the Jebel Hamrin was toned down and made almost interesting by the soft evening light and the purple shadows that suggested rest and coolness. There is something very impressive about these great stretches of plain at night even when viewed from such a prosaic conveyance as a railway train. The sense of stillness and solitude is very real and adds to the mystery which is inseparable from this ancient land. In the crude glare of the day, however, such ideas find no place, the dominant desire is to get away from it as quickly and completely as possible, for then—in the words of Kipling:—

"The earth is iron and the skies are brass
And faint with fervour of the flaming air
The languid hours pass."

The Mesopotamian railways have never been renowned for high speed or comfort, the decrepit nature of the rolling-stock and the temporary nature of the "permanent way" combining to keep the pace at eight to ten miles per hour. Daylight found us traversing the uplands of South-east Kurdistan, and the air was noticeably cooler and more invigorating,

coming as it did from the lofty summits of the Zagros ranges ahead of us. This mountain system forms the rampart between the plains and the western edge of the Persian plateau and all who wish to enter the land of the "Lion and the Sun" must cross this barrier. The appearance of the country had changed in our journey through the night, and so had that of the inhabitants. The sterile plain had given place to rolling downs stretching away to the foothills, beyond which could be seen the dim masses of the mountains of Armenia. The lean swarthy Arabs in flowing kuffiyahs had been replaced by the more robust, fairer skinned Kurds with their high black kolahs and bright cummerbunds.

No sooner had the train come to a standstill than a mob of coolies dashed along to the first-class carriage to seize the officers' kits and earn enough baksheesh to enable them to exist in peaceful idleness till the next train arrived. The urchin who succeeded in capturing my valise was a most amazing child in that, despite this sweltering heat, he was arrayed in a long sheepskin coat. Spreading a very tattered remnant of an army blanket on the ground he proceeded to pile on it not only my bulky kit but the kit of my orderly as well. It seemed impossible that this boy could carry away such a load, but no sooner was it settled securely on his back than off he went at a trot. The uninviting prospect of having to break my fast in the local restaurant, with the inevitable fat Armenian attendant and the no less inevitable thumb-marked poached egg, was banished by the appearance of the railway transport officer with the news that a rest camp existed some half mile away. A motor lorry was available and into it my now faintly perspiring pocket Hercules scrambled with the kit. Running through the camp is the Quairaitu Su, a small river whose clear sparkling water still rippled joyously over the pebbles despite the long summer drought. The river though so small is the dividing line between the military administrations of Persia and Mesopotamia, and those who dwell upon the farther or Persian bank are richer by eighty to one hundred rupees a month than their *vis-à-vis* on the other bank ten yards away. No sooner had we crossed the brook than we too were among the elect who could—and did—claim the benefits of this excellent Exchange Compensation Allowance. This all took place however in 1919.

II.

The journey from railhead across the mountain barrier to Kermanshah was to be done in Peerless motor lorries, a two days run with a halt for one night at Kerind, four thousand feet above our present level. This highway along which we were about to travel crosses the border mountains by the Tak-i-Gari pass, winds across the plateau to Kermanshah, then onwards and upwards over the Assanabad Pass to Hamadan, on to Khazivin and the capital Teheran. Beyond that city it passes on to the cities of inner Asia. No other highway in this part of the world is so rich in historical associations, for the record of the peoples who have passed along it is the record

of the great empires traced from the dawn of history to the present day. The armies of Assyria, Media, Persia, Parthia, Greece, Rome, the Arab hordes of Mahomet, the Seljuk Turks, the Tartars, Mongols, Turks, Russians, and now the British have swept along it on the tide of war. But not only has this been the route of conquering armies, it has been the channel of commerce flowing from east to west, for the products of China, Bokhara, Samarcand, and the cities of India have had to pass this way to reach the Mediterranean. It is the only practicable overland route between the Indus and the Tigris.

From Quairaitu the road traverses a series of low hills where not a breath of wind stirred the heavy air to blow away the thick clouds of fine dust billowing up from beneath the cars. We passed Kasr-i-Shirin, the palace of the beautiful princess, the fair Shirin. Legend has it that the great Rustam, the Black Prince of Persian chivalry, was out riding on the plain when he saw a most beauteous damsel bathing in a stream. So overcome was he at the beauty of the maiden that he straightway fell in love with her. Desire and possession were apparently synonymous terms to this gallant youth, for galloping up he lifted her across his saddle, leaving the scandalized companions to spread the alarm. He built a lovely palace for his lady love with beautiful gardens in which bloomed the far famed roses of Persia, and the bulbuls sang full sweetly among the trees in the scented evening air. These great blocks of stone and broken pillars near the road are all that remains of that idyllic scene.

From railhead to the camp at Sar-i-Pul is thirty miles. The camp is at the foot of the Tak-i-Gara Pass (Pai Tak) and here the motor convoys halt to fill up radiators and petrol tanks, in preparation for the three mile climb up through the mountain. The making of this road for motor traffic enabled the British authorities to carry out a great scheme of famine relief by employing the destitute villagers as roadmakers. The climb through the pass was quite exhilarating after the heat and dust of the plain, while the view over the edge of the road into the ravine is decidedly thrilling. At this point the slopes of the mountains have groves of oak and walnut which give grateful shade. Until the British forces entered this part of Persia the local Kurdish tribes used this pass as a happy hunting ground for the looting of caravans passing into and from Mesopotamia. Certain picturesque ruffians, heavily armed, were lounging about, but these were merely "friendlies" employed as road guards.

III.

Kermanshah was reached after two days' journey and it was a great relief to get away from the banging and jolting of the big motor lorries and the all pervading smell of petrol fumes. The road from Kerind is not very interesting, the crops were already harvested and only a few small orchards here and there broke the monotony of the plain.

Kermanshah is a relatively important town and is the capital of a rich

agricultural province. It has a population of 50,000, mostly Kurds, and is equidistant between Teheran and Baghdad. The town is built on the sides of a gentle slope and looks over a wide plain stretching away to the north where it meets a high limestone range that forms the limit of the view in this direction. The higher parts of the town are clean, for the better class houses are built up here and all have large gardens, but the lower parts of the town are filthy. Between the main road and the town is a stretch of ground covered with refuse, and the decaying carcasses of camels and donkeys poison the air with their stench. The bazaars are large, well stocked, and being roofed over are cool though somewhat gloomy. There is to be heard the usual din of the metal workers and the raucous cries of the itinerant vendors of sherbet and sweetmeats. There is to be seen the usual jostling crowd of mixed nationalities here—Persians, Kurds, Jews, Armenians, with occasional sepoys and British soldiers, all having to make way repeatedly for the incoming convoys of heavily laden donkeys and mules whose jangling bells add to the clamour in this market place. Here and there in the crowd one comes across the wild looking unkempt figure of a Dervish, collecting alms. In the quieter backwaters of the bazaar one not infrequently comes across what looks like a heap of rags till the black cloud of flies buzzing over it reveals the presence of an emaciated corpse. The Kurdish tribesmen here are dressed in the same fashion as those one sees in Suleimanyah and Halebja, with quaint high pot-shaped hats of black felt—some are of an enormous size. A bright coloured shawl is wound round the waist and those men in from the hills have their cummerbunds stocked with an imposing array of weapons, including the kanjar—a curved, broad-bladed, sharp pointed dagger. There is a steady stream of pilgrims passing down to the holy places at Kerbela and Nejef and convoys of corpses being taken down for re-interment in the great Shi'ite burial grounds. The money changers' quarter is not so interesting as that in Baghdad, but the variety of safes and cash boxes in use is considerable. The booths of the carpet merchants are great sources of attraction for the British officers, but really valuable and artistic rugs are not to be had. As is usual in these Eastern marts it takes two or three days to complete a deal. One very noticeable thing was the way in which the officers became afflicted to a greater or lesser extent with the two crazes—the exchange and carpets—but chiefly exchange. The daily fluctuations of the rupee, the kran, and the pound sterling appeared to fascinate some men and the conversation in the rest camp mess was given over largely to tales of successful "coups." The amateur financiers who had got "nipped" invariably maintained a gloomy silence, so that the degree of taciturnity prevailing was a pretty fair indication of the tone of the money market. Those who were stationed at Enzeli on the Caspian could indulge in a very orgy of speculation—in addition to their other duties—for they had at least eight brands of money to manipulate. There was the gold rouble, Czarist roubles, Kerensky roubles, the gold lira

the kran, the rupee, the pound and French Government bonds. The usual rumour that drifted down the L. of C. was that capital doubled itself every time the above series was successfully negotiated. Personally, I found the most pleasant and least harmful variety of exchange was that of rupees for iced "asabi" at 11 a.m. at the club.

Malaria, of a malignant type, is prevalent, and in the town where the water channels act both as drains and drinking supply there is much dysentery and enteric. When the Turkish troops were in possession here, the amount of sickness and number of deaths from malaria, typhus, and dysentery was so high that rumour credits the Divisional Commander—Ali Hussein Pasha—with having threatened to hang one in every ten of the medical staff unless there was a speedy improvement. Fortunately before the work of détermination could be carried out the division had to be hurried back to defend Baghdad.

The Governor of the province had recently arrived in Kermanshah and the British officers were invited to a reception at the palace. This is a big rambling building occupying one side of the Maidan. Outside the main gateway were lounging some of the Persian gendarmerie—a rascally crew—in dilapidated uniforms but with numerous cartridge belts. It was of interest to note the variety of types of ammunition carried by each man and only a few rounds appeared to be service ammunition. Passing through the deep archway we crossed a paved courtyard wherein the gendarmerie band was playing vigorously. Here we were met by an official, a very old man in a black gown and carrying his silver-topped wand of office. He conducted us to a small ante-room where we waited for a few minutes, and were then ushered into the salon. Here we were greeted by the Governor and introduced to various officials, after which tea was served. A number of deep, snug armchairs, the delicate china of the tea service, and the delicious tea cakes gave a touch of Western comfort to the otherwise bare apartment. The carpets were very fine and on the walls were many beautiful Kashans. The Governor—a prince of the royal house—was a comparatively young man with a charming manner and a ready smile, forming rather a contrast to his councillors, elderly men of serious mien.

Conversation was carried on in French, and for my part I found cause to regret that the study of the whereabouts of the pen of my aunt and similar school-room topics should leave one so ill equipped for the easy exchange of Gallic witticisms in the drawing room. At the ideal moment whisky was handed round, the diluent being fresh spring water. The drink was of such excellence that it can best be described in the words of Thomas Burke as "gold wrapped in velvet."

One evening an opportunity of visiting a local opium den was presented to me. I accepted this invitation in the hopes of catching an interesting glimpse of things behind the scenes. After dinner three of us with a guide faded away into the dark, and were led through a complicated

series of narrow alleys each replete with a variety of smells. The guide trusted to the plan of following his nose, for the further we went the stronger the smells, but at last he halted us before a low iron-studded door. After certain soft knockings and whisperings had been exchanged with the custodian, the door creaked open. We crossed a small courtyard and



FIG. 1. —Tak-i-Bustan.

passed into a low dimly lit room. The only light was that of a small spirit lamp. There was complete silence, and the air, heavy and dry, had a sickly taint of unwashed humans and opium fumes. As the eyes became accustomed to the gloom we could make out several figures lying stretched out on the floor, drugged. The owner of the establishment was squatting beside the spirit lamp preparing the pipes. These were wooden stems

about a foot long, one end fashioned into a mouth piece the other fitting into a china bulb. A pellet of the drug is warmed in the flame, pressed against a small hole in the bulb, and the pipe handed to the customer who inhales the fumes deep into the lungs. The performance so far had been extremely dull and sordid and the element of absurdity was added when a hitherto motionless figure near us suddenly came to life, seized a satchel that had been serving him as pillow and from it drew out brushes, rags, tins of boot polish, and . . . a roller skate! We left in haste. Another illusion of the "Mystic East" had been shattered.

In the centre of the town is an interesting mosque to which we could

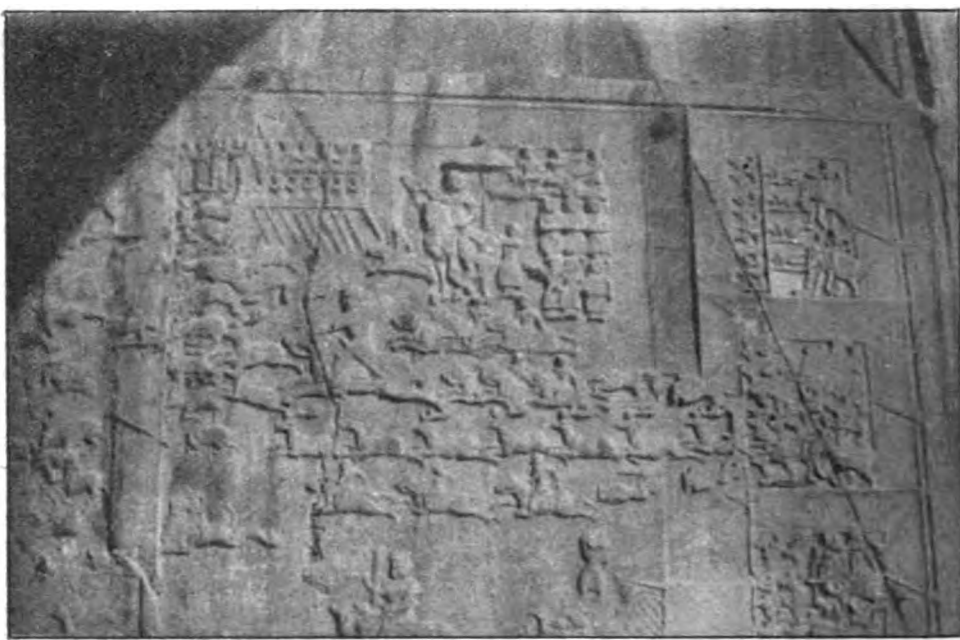


FIG. 2.—Tak-i-Bustan. The Stag-hunt.

get admittance. In it are numerous mural paintings showing with great detail the tortures inflicted on prisoners of war a thousand years ago. The frightfulness of the surgical operations made one's blood run cold. In marked contrast to the clamour of the bazaar and the filth of the narrow streets was the cool freshness of the gardens above the town. Turning down the lane beside the British Hospital and clambering over a crumbling wall, one entered a realm of grateful shade and murmuring streams. In the clearings a few gardeners could be seen at work on the vegetable plots near which the workers had placed their brushwood shelter, a few reed mats, and a samovar. Fruit grew everywhere in rich profusion, and with ready kindness a gardener would fill your hands with fresh plucked fruit—

purple grapes, golden figs bursting with sweetness, and peaches warm from the sun. Deep in a thicket of evergreens beside the stream was a stretch of turf all dappled with the shadows of the tangle of foliage overhead. How soon forgotten was the noonday heat, the dust and flies, as you lay on this grassy couch in drowsy peace, gazing up with half-shut eyes at the sheltering leaves dancing in the breeze that came stealing down the valley.

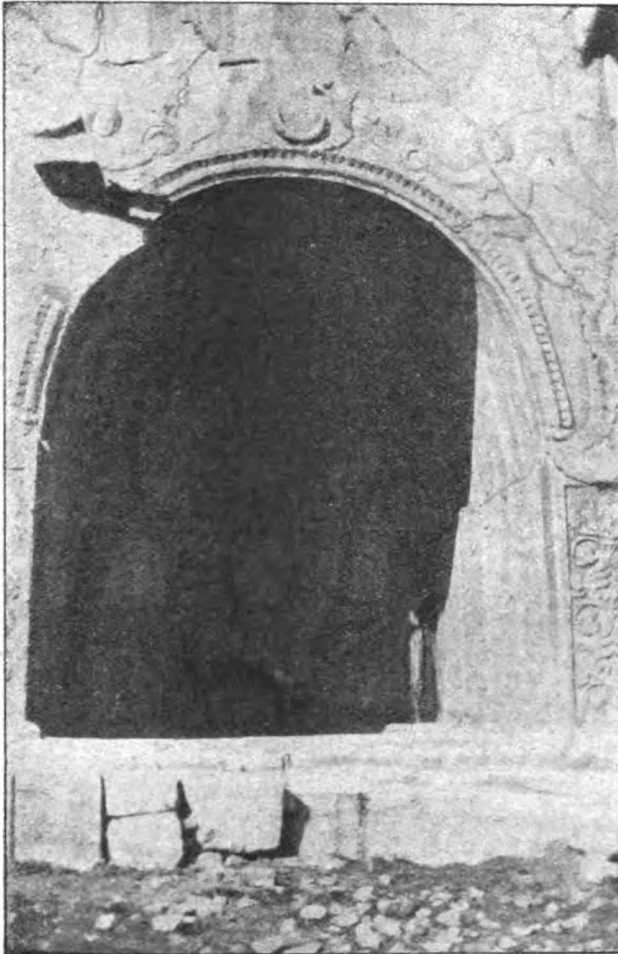


FIG. 3.—Tak-i-Bustan.

IV.

The neighbourhood of Kermanshah is rich in monuments of the past greatness of Persia. Twelve miles away to the north-east you come to the pool of Tak-i-Bustan at the base of a great crag. Hollowed out of the rock are two deep arches, on the walls of which are sculptured figures of

the Sassanian kings, and the artists have carved with great skill and fidelity to nature the hunting scenes that took place in the royal parks or "paradises." These "paradises" were large tracts of fertile land, stocked with wild animals such as the boar and the stag. These enclosures were rigorously preserved, and here the kings took part in the chase.



FIG. 4.—Tak-i-Bustan.

On one of the walls is a bas-relief of the "stag hunt." The monarch—as can be seen from the photograph—is on horseback, shaded from the sun by an umbrella held by an attendant, and below him huntsmen armed with bows and arrows are in pursuit of the quarry. Near the king are musicians. It would have been interesting to have John Jorrocks's views on this form of "'unting," which, although in this case literally "the sport of kings" would have drawn some very caustic remarks from the great M.F.H.

On the opposite wall is a representation of a "boar hunt" with the monarch taking a more active part in the pig-sticking. Musicians are again in evidence. The inner wall of this arch is occupied by the huge figure of Khursu Parviz (A.D. 590 to 628)—in the upper half shown as receiving the symbol of kingship, and in the lower he is shown on horseback.

On the rock face near the arches have been carved a group of three great figures representing Ardashir I receiving the chaplet of kingship from



FIG. 5.—Behisitun. Bas-relief of Darius.

the god Ahuramazda. On the other side of the king is Zoroaster, and beneath his feet is the body of Artaban, the Parthian monarch overthrown by Ardashir.

Tak-i-Bustan was a favourite place for picnics, and close to the pool is a huge walnut tree that gave ample shade for the luncheon. There was a chaplain at Kermanshah at this time who used to organize these outings, and his talks on the ancient monuments and history of Persia were very interesting and popular. But it is at Behsitun one finds the most historic monument—the great carving of Darius and the tri-lingual cuneiform inscriptions.

The range of hills stretching across the plain meets the Hamadan road eighteen miles from Kermanshah and ends abruptly at the road-side in a perpendicular wall of rock 800 feet high. At a height of 300 feet above the

road Darius caused to be carved the great bas-relief commemorating his victories over his enemies (521—519 B.C.). The accession of Darius to the throne was the signal for the outbreak of a series of rebellions of the governors in Babylonia, Susiana, Media, and the outlying provinces of the Empire. In two years' time, however, Darius had crushed his opponents and stamped out the fires of revolt. To the left of the bas-relief we see the figure of the great "king of kings" of a stature greater than that of his subjects and holding in his outstretched hand the bow—the weapon of the Median and Persian armies that had produced the great victories of Cyaxares, Cyrus, and Cambyses, whereby the great empires of Assyria, Babylonia, and Egypt had been overwhelmed. In front of Darius are the captive rebel princes, and beneath the feet of the king lies Gaumata—his chief enemy. Over all hovers the supreme god Ahuramazda holding out the chaplet of victory to Darius. It is of interest to recall that at the death of Darius the Persian Empire extended from the Danube to the Indus and from the Nile to the Syr-darya. Beneath the bas-relief are the famous cuneiform inscriptions in Old Persian, Median, and Assyrian describing the exploits of the Achæmenian monarch above.

It was the discovery and decipherment of these inscriptions by Sir Henry Rawlinson that revealed the meaning of the Assyrian and Babylonian inscriptions. This pioneer work of Sir Henry Rawlinson at Behsitun was the foundation stone on which the whole structure of Assyriology has been erected. The life of this great soldier, ambassador, and assyriologist, as set out in the "*Memoir of Sir Henry Rawlinson*," by Canon Rawlinson, makes most interesting reading. From the "*Memoir*" we learn that Rawlinson, at the age of 17, arrived in Bombay in 1827, and was gazetted to the 2nd European Infantry Regiment, then to the 7th Native Infantry, and later to the 1st Bombay Grenadiers. At the end of six months he had passed his Interpreters' examination in Hindustani, and at the end of the year the examination in the Maharatta dialect. While at Poona (1830—33) he was an outstanding personality in the social life of the station and in all sports. He excelled in steeplechasing, shooting, and pig-sticking. His most renowned sporting achievement at this time was a ride against time which attracted much attention both in India and at home. The terms of the bet were: "To ride from Poona to Panwell in four hours—the stake to be £100—a forfeit of one hundred rupees to be paid for every minute over the four hours, and the same amount to be guaranteed to the rider for every minute under that time." Rawlinson started out from Poona at 5.10 a.m. and arrived at Panwell at 8.17 a.m. He therefore covered the distance of seventy-two miles in three hours seven minutes. He also passed a first-class examination in Persian.

In 1833, at the age of 23, he was selected as one of eight officers of a military commission that was being sent to Persia to re-organize the Shah's army. After some time spent at Tabriz and at Teheran he was nominated by the Shah to proceed to Kurdistan and assist the Governor of the

province—the Shah's brother—who resided at Kermanshah. Rawlinson was in this district from 1835-7, and during that time his duties were many and varied. He had to raise, equip, and drill a force of 3,000 Kurdish levies, subdue rebellion, and assist in putting the finances on a sound footing. He was awarded the Gold Medal of the Royal Geographical Society for his explorations in Luristan. He was intensely attracted by the cuneiform inscriptions at Behsitun and made many visits to the rock to attempt to scale the cliff. Until he arrived in Persia this young officer had never seen cuneiform writing, and was entirely ignorant of the values of the wedge-shaped signs. While on his journey from Teheran to Kermanshah Rawlinson had seen the cuneiform inscriptions on Mount Elwand at Hamadan, and to quote from the "Memoir": ". . . here he was able for the first time to make a leisurely examination of cuneiform inscriptions, and was induced to copy them and ponder over them and endeavour to penetrate their meaning . . . They had already been partially deciphered by those eminent scholars (Burnouf, of Paris, and Lassen, of Bonn), but the results of their labours were wholly unknown to the young Englishman, who commenced his own study of the Elwand inscriptions without any acquaintance with any similar previous researches."

It was not till 1847 that Rawlinson was able to obtain accurate casts of the Behsitun inscriptions. This was accomplished by the daring of a Kurdish shepherd boy. By a close study of the wealth of material thus obtained, "a chapter of the world's history that had been almost wholly lost once more made known to mankind."

Echoes of the Past.

A CHRISTMAS KALEIDOSCOPE.

BY COLONEL S. F. CLARK (R.P.).

ON Christmas Eve, 1904, I embarked on the R.M.S. "Walmer Castle" for a tour of service in South Africa, and next day I mentioned to a civilian fellow-passenger that, since I had joined the service I had hardly spent two consecutive Christmas days in the same place. He remarked that no words of mine could have brought home to him more vividly what life in the Army meant. Now that my movements are more under my own control, the remembrance of this conversation has led me to trace my whereabouts on that great festival for each year that I was on the active list, and others may like to follow up the idea for themselves. They will doubtless agree that the R.A.M.C. officer has few opportunities of spending Christmas at his parental home—even if it is still in being on his retirement.

December, 1886, was the first Yuletide on which I wore uniform—as a Surgeon on probation at Netley. About a dozen of us, whose homes were

a long way off, did not take the short leave that was available, and we had a very merry time. We were much amused when two or three of our comrades who had gone away came back, very unostentatiously, before they were due, with all their money spent. We told them that it was a military crime for a man on leave to return before its expiration, and their uncertainty as to the truth of this made them very unhappy.

Twelve months later I returned, on holiday, to my home in Edinburgh, already, as it proved, for the last time at this season.

Christmas, 1888, found me on the old troopship "Crocodile," bound for India, and still a week's sail from Bombay. In 1889, I was for over ten weeks on a 600-miles march with cavalry changing station between Meerut and Mhow, and spent Christmas Day of that year with a party of the 18th Hussars at Sathkunda camping ground, not far from Neemuch. The E.P. hospital tent was pitched as a dining hall, and the men had a thoroughly enjoyable time. Next year I dined with the P.M.O. at my station, Mhow, in keeping with the tradition that the senior officer of the corps invites his officers and their wives to feast with him at Christmas. I can still see the 2nd Middlesex marching to church that morning to what soon afterwards became the tune of our Corps—"Her bright smile haunts me still." An unusual incident happened at this time, for the 18th Hussars, who had gone into the jungle *en masse*, for several days picnic, were ordered back by the Commander-in-Chief, Lord Roberts, on the complaint of the Chaplain that they were out of reach for Church Service. They went out on the 23rd and came back on the evening of the 24th, not at all in good humour with the padre.

In November, 1891, I was transferred to Aden and was doing duty at the Crater on Christmas Day. A cornet player of the band of the King's Regiment acted as "waits" on the previous night, and the notes of his instrument echoed and re-echoed from rock to rock in a wonderful way. A year later I was still in Aden, but at Steamer Point.

Christmas Day, 1893, found me at Karachi, and I spent the festival on the following year at Deolali, awaiting passage to England. I was married now, and my wife and I spent the Yule of 1895 at Dover, and that of 1896 at Brighton—each place being my station at the time. A year later we were on the hired transport "Jelunga," near Hong Kong, our destination. As this was a self-contained station it seemed that I must at last have some fixity of tenure, and although I spent the next five Christmas Days at Hong Kong, yet my habitation was in three different places. In 1898 we were living at the Hong Kong Hotel and dined with the P.M.O. In 1899 and 1900 we had a furnished house at the Peak, and gave dinners ourselves. The next two years found us deprived of our house, with accommodation everywhere very tight, and we were glad to get into a boarding establishment at the Peak.

On Christmas Day, 1903, I was orderly officer at the Military Hospital, Devonport, and, on going to the O.M.O.'s room in the evening, I found

the orderly who had brought my bag prostrate on the floor, fast asleep, and my bag lying out of his reach. He had apparently gone down with a beery thud.

1904 I have already referred to, and the next three years were spent in one of the officers' bungalows, at Tempe Ridge, Bloemfontein. In 1908 I was at Middelburg, Cape Colony, and my chief recollection of that Christmas is acting as prosecutor at a court-martial on the dispenser on duty, who was charged with drunkenness on duty on December 25. What keeps this in my memory is a reprimand I got from the Commander-in-Chief, South Africa, for saying, in my opening address, that though drunkenness at Christmas was not frowned upon so relentlessly as at other times, yet a case like this could not be overlooked. The Commander-in-Chief said that there was no laxity in regard to Yuletide excess. I suppose it is one of the things that is better understood than expressed.

In 1909 we were in a house at Pietermaritzburg, Natal, and a few days later I went to Durban to see a cricket match between England and South Africa. I mention this because it completed a quaint record of mine, in that it was only the third Test Match that I had seen, and each of them in one of the three only countries in which Test games are played. The first was at the Oval, in 1886, after I had sat for examination for entrance into the Corps: the second was in Sydney, in 1908, and the third I have just referred to. Hobbs is the only member of the English 1908 XI who could still get a place in a Test team, while Woolley played at Durban.

At Christmas, 1910, I was under orders for home, and we had sold up and were in a hotel at Maritzburg, but as we left for Durban four days later we narrowly missed spending that day in that seaport.

1911 was the first time since 1887 that I had leave at Christmas, but as my parental home existed no longer, we went over to some relations in Dublin. 1912 and 1913 were spent at Chester, and Christmas 1914 found me in France. A year later I was at Brighton, on sick leave, recovering from an injury which I had received "over there," while A.D.M.S. of a Division. The next two festivals I passed in Macedonia, and my last Christmas Day in the Service was spent once more at Brighton on short leave.

I am confident that anybody who does me the honour of reading this article will agree that the civilian has less glorious uncertainty about where he is likely to spend his Christmas Days than has the soldier.

Reports and Analysis.

COAGULEN-CIBA.

A NEW hæmostatic received from the Clayton Aniline Co., Ltd., 68½, Upper Thames Street, E.C.4, has been tried on half a dozen cases of hæmorrhage from ulcerated surfaces—gastric ulcer; it appears to increase the coagulability of the blood in such cases and has a beneficial effect as a hæmostatic.

Current Literature.—Surgery.

Surgical Treatment of Osteo-arthritis. By C. Max Page (*Brit. Journ. of Surg.*, xii, No. 45, July, 1924).—In the above journal Mr. C. Max Page discusses the surgical treatment of Osteo-arthritis. The article formed his Hunterian Lecture at the Royal College of Surgeons of England on February 6, 1924.

While drawing attention to the importance of early treatment to check the advance of the disease by the elimination of septic foci and the avoidance of strain or injury, the paper deals mainly with the cases where surgical interference is called for. These are defined by the author as consisting of:—

- (1) Persistent pain.
 - (2) Progressive deformity.
- He discusses the points for and against.
- (1) Excision of the joint.
 - (2) Arthroplasty.
 - (3) Erasion of the joint.
 - (4) Synovectomy.

Dealing with the disease as affecting the various joints of the body, it is pointed out that, in the case of the hip-joint, the operative procedure selected is determined by the age and general condition of the patient. Thus, in the young or middle-aged, bony ankylosis at the joint line should be aimed at by complete erasion of the joint. In elderly or feeble patients an arthrodesis is not usually recommended, but simple excision of the head of the femur is most favoured. While this relieves pain, the patient is condemned to the use of crutches or a caliper.

In the experience of the author erasion of the joint has been well tolerated by old patients, but in them no attempt at rigid fixation in plaster of Paris is attempted.

The great tendency to adduction deformity, following operation on the hip-joint, is pointed out, and the reasons are discussed. To prevent its occurrence, the neck of the femur should be preserved and the function of the gluteus medius and minimus and tensor fasciæ femoris conserved.

The various procedures that may be adopted for the knee-joint are mentioned, and the author considers that arthroplasty of this joint for osteo-arthritis in young patients is worth a trial, as if it fails a later operation to obtain bony ankylosis can be carried out.

Arthrodesis when applied to the ankle-joint has not proved satisfactory owing to the later development of pain in the tarsal joints.

A simple astragalectomy is also unsatisfactory. For the joints of the upper extremity operation is less frequently necessary, but even in these operation is often the only means of restoring function. In the shoulder, if operation is justified, an arthrodesis of the joint, with the humerus

abducted to forty-five degrees, and externally rotated and anteverted, gives the best result.

The choice of arthrodesis or arthroplasty for the elbow-joint is governed by the social position of the patient.

The results of operation on the wrist-joint have proved disappointing, whether the proximal row of carpal bones or the whole carpus was excised.

For the temporomaxillary joint excision of the condyle relieves the pain, but some deviation of the jaw towards the affected side occurs.

One of the most interesting parts of the paper is the discussion of the technique of operation on the hip-joint.

The author in a series of thirty-five cases has utilized three routes of approach : The posterior, the supero-lateral, and the supero-anterior.

Posterior Route.—With regard to the posterior incision. An oblique cut is made in the direction of the fibres of the gluteus maximus, which are then separated to expose the posterior part of the joint. It is pointed out that the view of the joint is limited, and dislocation of the head of the femur cannot be secured with certainty. Consequently one of the other methods is to be preferred.

The Supero-external Route.—The author has found this to be one of the most satisfactory methods, especially in old patients.

A curved incision is carried from the anterior to the posterior inferior spines of the ilium with the convexity downwards. This flap is turned upwards and the tendon of the gluteus maximus divided in line with the anterior margin of the great trochanter. The great trochanter of the femur is then divided by an osteotome and drawn upwards carrying with it the attachment of the gluteus medius, minimus, pyriformis and gemelli.

The anterior edge of the gluteus medius is separated from the posterior part of the tensor fasciæ femoris. This gives a good exposure of the superior and posterior aspects of the joint.

This operation involves no destruction of muscle or nerves and no important vessels are met with:

The Supero-anterior Approach.—The incision consists of a curved section parallel to and just below the crest of the anterior half of the ilium, and a vertical incision five inches long to meet the anterior extremity of the curved incision.

The origins of the gluteus medius and tensor fasciæ femoris are cut through half an inch below the iliac crest. The fascia lata is divided at the anterior margin of the tensor fasciæ femoris. The muscles are separated from the ilium and include the gluteus minimus.

This gives a good exposure of the anterior and upper parts of the joint.

To dislocate the head of the femur the capsule is incised, and the outer border of the ilio-femoral ligament divided. This route gives an excellent exposure of the joint, but the author considers it is not as satisfactory as the supero-external route.

Technique of Operation on the Knee.—It is pointed out that excision of

the knee for osteo-arthritis sometimes fails to result in firm bony union. To obviate this the author recommends that:—

- (1) The synovial pouch should be dissected out.
- (2) Vascular cancellous bone should be exposed by the bone sections.
- (3) The patella, after having its articular cartilage cut off, should be pegged to the tibia by a long French nail.

The author prefers an H-shaped incision to the usual U flap.

In the after treatment of hip-joint cases immobilization in correct position in plaster of Paris is recommended where bony union is aimed at.

Where fibrous union is deemed sufficient, as in the case of elderly patients, the limb is slung in some form of a splint like Hodgen's.

In knee-joint cases, if the technique recommended is employed, a simple gutter splint suffices at first, which is changed to plaster-of-Paris at the end of two weeks.

Complete details of thirty-four cases of osteoarthritis of the hip-joint treated by operation are given in tabulated form.

In estimating the late results of operation the author considers that the surgeon demands a higher standard of functional usefulness than the patient who is usually happy to be relieved of his pain. The restoration of function is especially important in young subjects.

A further table shows the results of twenty-four cases of erosion of the hip-joint at least one year after operation.

This shows that nine had bony ankylosis, and five had ankylosis of a doubtful nature, while ten had fibrous union only. Nineteen cases showed some adduction deformity. Pain in the hip was absent in nineteen cases and was slight in five. The average functional shortening was 1.5 inches. The functional value of the limb was good in thirteen, fair in eight, and poor in three.

In the case of the knee-joint, arthrodesis resulting from excision has given good results both as regards relief from pain and functional usefulness of the limb. In fourteen cases reported by the author bony ankylosis was secured in all cases.

With regard to the operation of synovectomy for hypertrophic villus synovitis, four cases are mentioned in which recurrent effusion was relieved and fair movement of the joint attained.

The article is well illustrated by coloured plates and numerous excellent skiagrams. It is well worth careful perusal by all surgeons interested in this serious and crippling disease.

The Median Extraperitoneal Route to the Ureter (*Brit. Journ. of Surg.*, vol. xii, No. 45, July, 1924).—K. W. Monsarrat draws attention to this method in the above journal. He claims that for calculi situated in the ureter during its passage through the pelvis it is superior to any of the other methods of approach. Although stones situated about the pelvic brim can be readily removed by the inguinal route, the author states that by this method suture of the ureter may be difficult unless the stone can

be displaced upwards to a convenient position. He is strongly opposed to the transperitoneal method of approach. His description of the operation is as follows:—

“An incision is made from umbilicus to pubis, the aponeurosis is divided to the same extent, the recti are bluntly separated, the extraperitoneal plane is reached. If the calculus is in the right ureter, separation of the peritoneum proceeds on that side towards the iliac fossa, continued round the pelvic basin until the common iliac bifurcation is reached, when the ureter is found and comes off the vessel with the peritoneum. A large broad-bladed retractor is then inserted and displaces inwards the peritoneal sac and its contents.

“The ureter is then traced to the point of impaction of the calculus, and this is displaced as may be thought desirable and removed.

“After suture of the ureteral wound a stab wound is made through the abdominal wall in the right iliac fossa through which a half tube passes towards the site of the ureteral end. Retractors are then removed, the peritoneum falls back into place and the median wound is sutured throughout its length.”

Illustrative cases are quoted.

Bladder Injury during Hernia Operations. Leigh F. Watson (*American Journal of Surgery*, April, 1924).—Large, irreducible, or strangulated hernias often present unusual difficulties, sometimes taxing the skill of the most experienced operators. The danger lies in accidental injury to the bladder, intestine, blood-vessels or vas deferens. The bladder is involved in about one per cent of all inguinal hernias in adults. In certain cases it is only by a most careful examination of the sac that bladder injury can be avoided. Bladder wall should be suspected when the sac is thick, when it is covered by a quantity of lemon-coloured peritoneal fat, or when there are numerous blood-vessels on its surface. When the bladder is in the sac wall it is nearly always on the inner side, and for this reason the sac should always be opened at a thin white point on the outer side.

Reviews.

THE MEDICAL DEPARTMENT OF THE UNITED STATES ARMY IN THE WORLD WAR. Vol. xv. STATISTICS. Part I. Army Anthropology. Pp. 635.

This volume falls, after its introduction, into two main parts—I, physical measurements; II, a consideration of the chief of these measurements in relation to various diseases and defects—followed by an appendix of correlations between the various measurements recorded in different types and races of men, and is completed by an adequate index. It is fully “illustrated” throughout by tables and graphs. Co-ordination of effort and result have been assured as far as possible by the supervision of skilled anthropologists.

A large amount of the work was undertaken, under the orders of the General Staff, to provide special data for obtaining measurements for uniforms, and the great mass of these, though not all of medical or military interest, provide comparative racial pictures of the healthy portion of the young adult male population of the United States at the present day.

From our point of view it is important to remember that the United States recruit of 1917-18 was between the ages of 20 and 30, with an average age of 24·89, and that the actual recruiting standards of the U.S. Army were somewhat different from ours; their standard chest measurement is taken at complete expiration and with the tape placed "perpendicular to the axis of the trunk at the level of the nipples"; further, with measurements of either pounds or inches, fractions of less or more than one half are recorded as the whole number below or above respectively: consequently these figures may not be absolutely comparable with those of our own or other armies as regards either recruits or trained soldiers. The average measurements of approximately two million recruits given in this volume are: height, 67·49 inches; weight, 141·54 pounds; minimum chest circumference, 33·22 inches. Of the 100,000 "veterans" who were re-measured on demobilization, the average gain in weight was 3·35 pounds; this places the weight of the trained soldier of 26 years of age at 145 pounds.

An important part of the volume (Subsections V and VI of Part C, Section I) is devoted to the consideration of "build" and "robustness." "It is not too much to say that the principal reason for taking weight in connexion with height, is to secure a numerical statement of the build as a first means of deciding upon the acceptance or rejection of a recruit for military service." The formula accepted for the estimation of "build" is: weight in pounds \times 1,000 divided by the square of the height in inches: this gives an index which is stated most nearly approximate to the observed facts, the average for these two million recruits being 31·08. In the latter of these two subsections Pignet's factor is discussed and its importance in the estimation of "robustness" is stressed. For the same men the average Pignet's factor was 22·76, corresponding to the medium degree of robustness, or, in English equivalents (Balck Foote's modification of Pignet's formula), about 108, which had increased on demobilization to 115.

With regard to chest measurements, importance is attached to the "relative chest circumference"—i.e., chest circumference (expiration) divided by the total height, which averaged 0·492 inch per inch of height. Lateral and antero-posterior caliper measurements of the chest have doubt thrown on their absolute value owing to the comparatively large normal variations: the thoracic index varies racially to a large degree and "its military significance is probably confined to its medico-military significance," i.e., as a possible indicator of pulmonary tuberculosis: in any case it gives no indication of the mobility of the chest.

Pages 242 to 253 contain a very interesting summary of the dimensions of the average individuals of eight European races in the United States.

Of the many measurements, other than the three already referred to, which are recorded, perhaps the one of chief interest is the pubic height, i.e., the vertical height of the top of the pubic arch in the middle line. This gives, within 35 millimetres, the actual length of swing of the leg from the acetabulum, and may be made use of for grading men for marching, in that men of the same leg length will march more efficiently in company than men of diverse leg lengths. This measurement is shown to vary in European races from 50.89 per cent of the total height in the French to 50.13 per cent in the Italians.

It seems a pity that the trunk length (sitting height) was taken with the subjects sitting on a form or box in view of Dreyer's conclusion that this method is liable to considerable error compared with that in which the subject sits, as nearly as possible, on his ischial tuberosities and not on his gluteal muscles. This method of measuring may account for the high standard deviation which is found in this series.

Section II, on physical measurements in relation to various diseases and defects, reveals the outstanding fact that the more important invaliding diseases are associated with defective weight, especially when considered in relation either to height alone or to height and chest circumference. But it must be remembered that the measurements in this Section are those of men who had been passed as medically fit for service in the first instance and were rejected later by Mobilization Camp medical boards; still, they serve as a very useful guide, and probably the deficiencies noted would stand out even more prominently if the original rejections by local examining officers were included also.

We are left with the conviction that for military purposes the three standard measurements of height, weight and chest circumference (including mobility) and their inter-relation with each other are the really vital ones, and also with a very definite admiration of the anthropologists and staff of the Medical Record Section of the United States Surgeon-General's office who prepared this volume, a valuable contribution not only to military, but also to racial anthropology. R. A. M.

A MANUAL OF SURGICAL HANDICRAFT AND PHYSIOTHERAPY. Vol. I.

By J. Renfrew White, M.S., F.R.C.S. Coulls, Somerville, Wilkie, Ltd., Dunedin, N.Z. 1923. Pp. xxi + 566. Price

This book is intended for junior medical students. It is profusely illustrated, and written in a readily assimilated style, with liberal use of thick type.

A feature of the book is the inclusion of historical matters. Before discussing asepsis and antisepsis, the author gives a short history of the rise of modern surgery. He includes short historical sketches of great men, such as Pasteur and Lister, whose portraits are included, and he shows the operation of 1882 in comparison with that of the present day, both illustrations being taken from "Keen's Surgery." In this way he succeeds in enhancing the education value of his work.

The book contains in its 566 pages a great deal of surgical information made up in readable form.

M. B. H. R.

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C.L. = Current Literature.

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